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(54) **SYSTEM AND METHOD FOR MANAGING CONFERENCING IN A DISTRIBUTED COMMUNICATION NETWORK**

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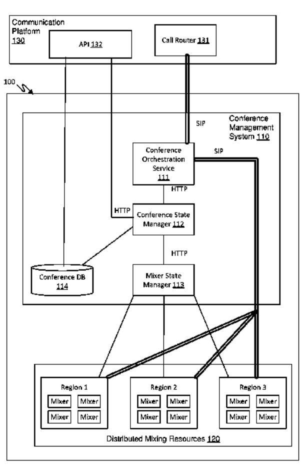
(57) **ABSTRACT**

Systems and methods for a conferencing system. Responsive to a new conference request received at a conference orchestration service, participants of the conference and participant regions for each determined participant are determined. A mixer topology is generated that specifies an assignment of each determined participant to at least one input channel of a plurality of mixers. A mixer state manager generates the mixer topology based on the determined participant regions and at least one regional association of a mixer. Media of each determined participant is routed to the assigned at least one input channel according to the generated mixer topology by using the conference orchestration service. The mixer state manager generates the topology responsive to a request provided by the conference state manager. The conference orchestration service receives the generated mixer topology from the mixer state manager via the conference state manager.

20 Claims, 16 Drawing Sheets



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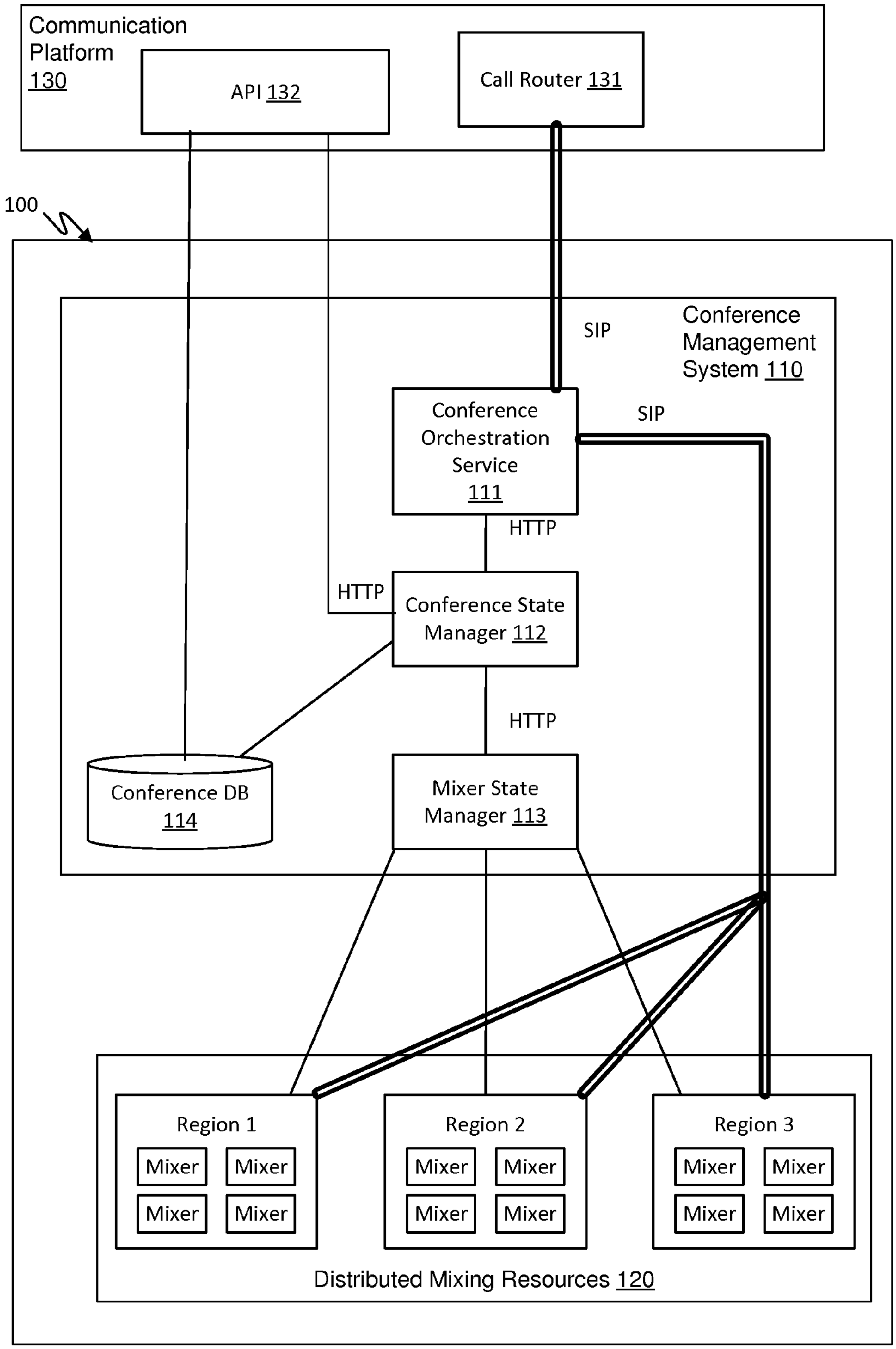

Communication Platform 130
API 132
Call Router 131
100
SIP
Conference Management System 110
Conference Orchestration Service 111
SIP
HTTP
HTTP
Conference State Manager 112
HTTP
Conference DB 114
Mixer State Manager 113
Region 1
Mixer
Mixer
Mixer
Mixer
Region 2
Mixer
Mixer
Mixer
Mixer
Region 3
Mixer
Mixer
Mixer
Mixer
Distributed Mixing Resources 120

FIGURE 1

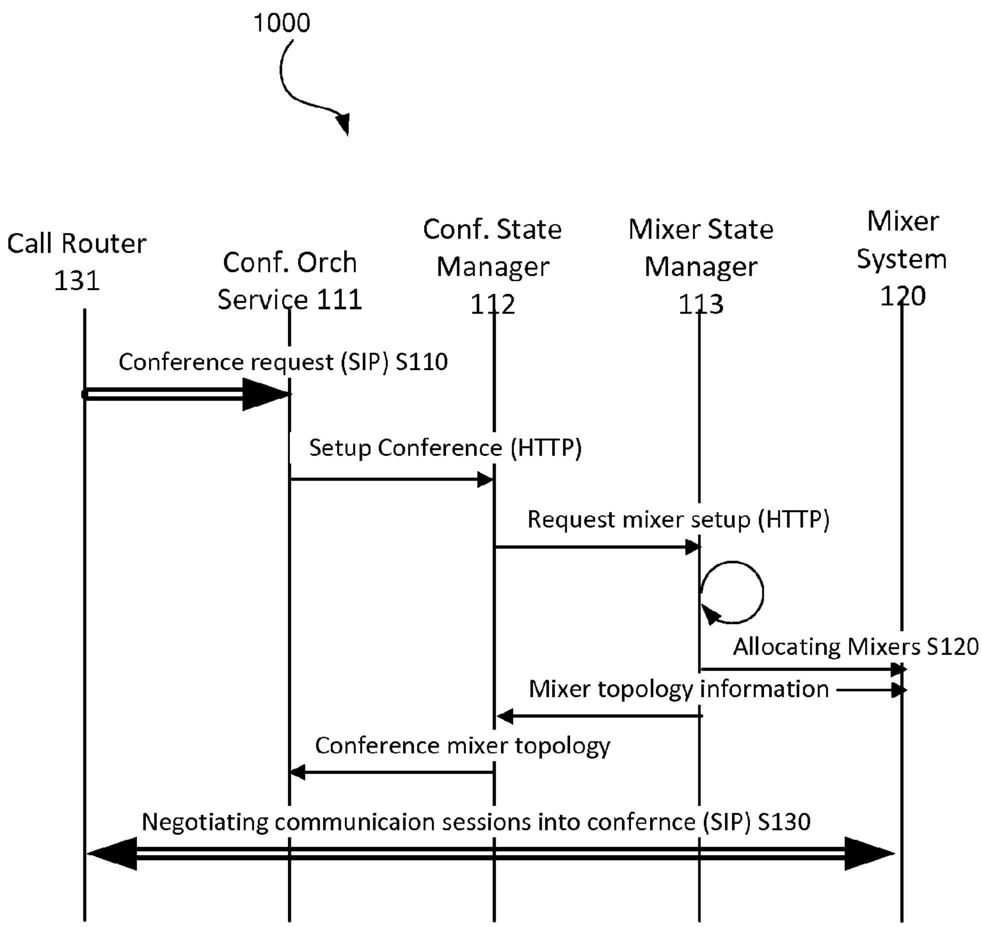

1000
Call Router
131
Conf. Orch
Service 111
Conf. State
Manager
112
Mixer State
Manager
113
Mixer
System
120
Conference request (SIP) S110
Setup Conference (HTTP)
Request mixer setup (HTTP)
Allocating Mixers S120
Mixer topology information
Conference mixer topology
Negotiating communicaion sessions into confernce (SIP) S130

FIGURE 2

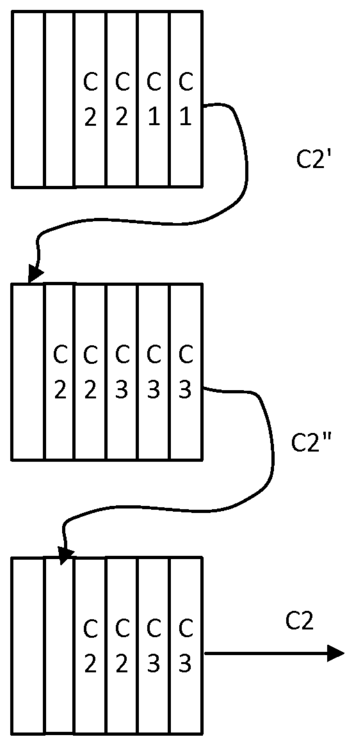


FIGURE 3

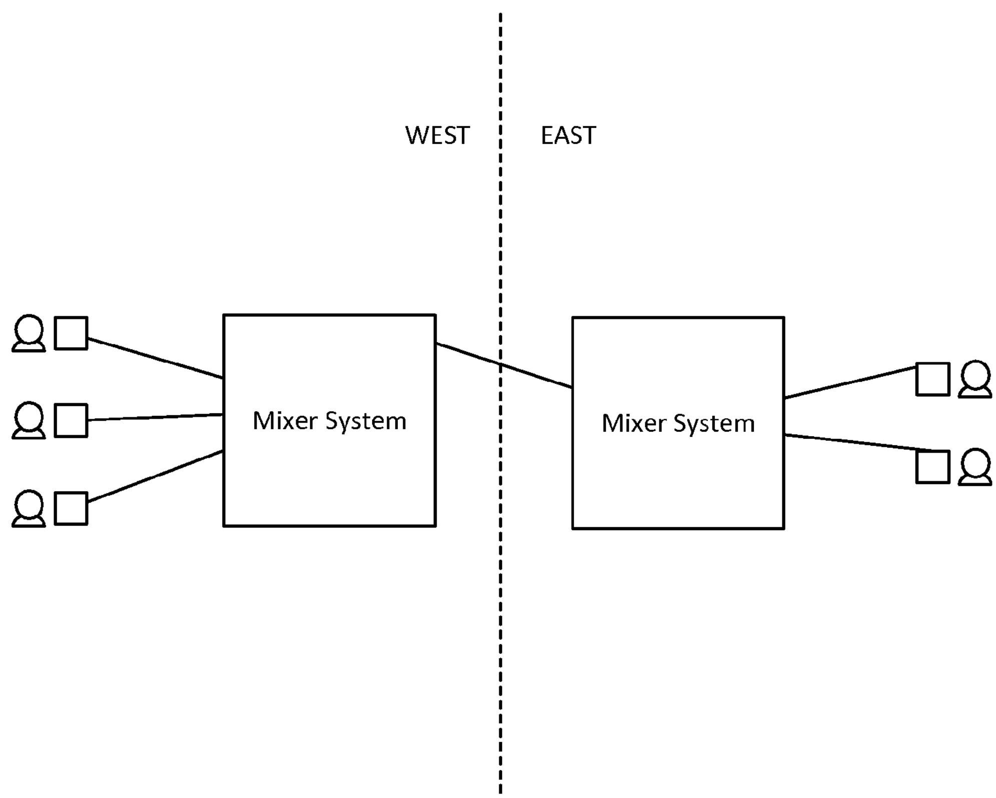


FIGURE 4

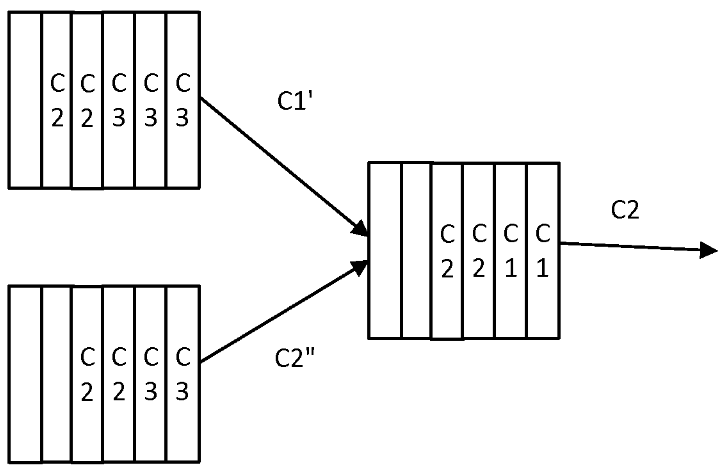


FIGURE 5

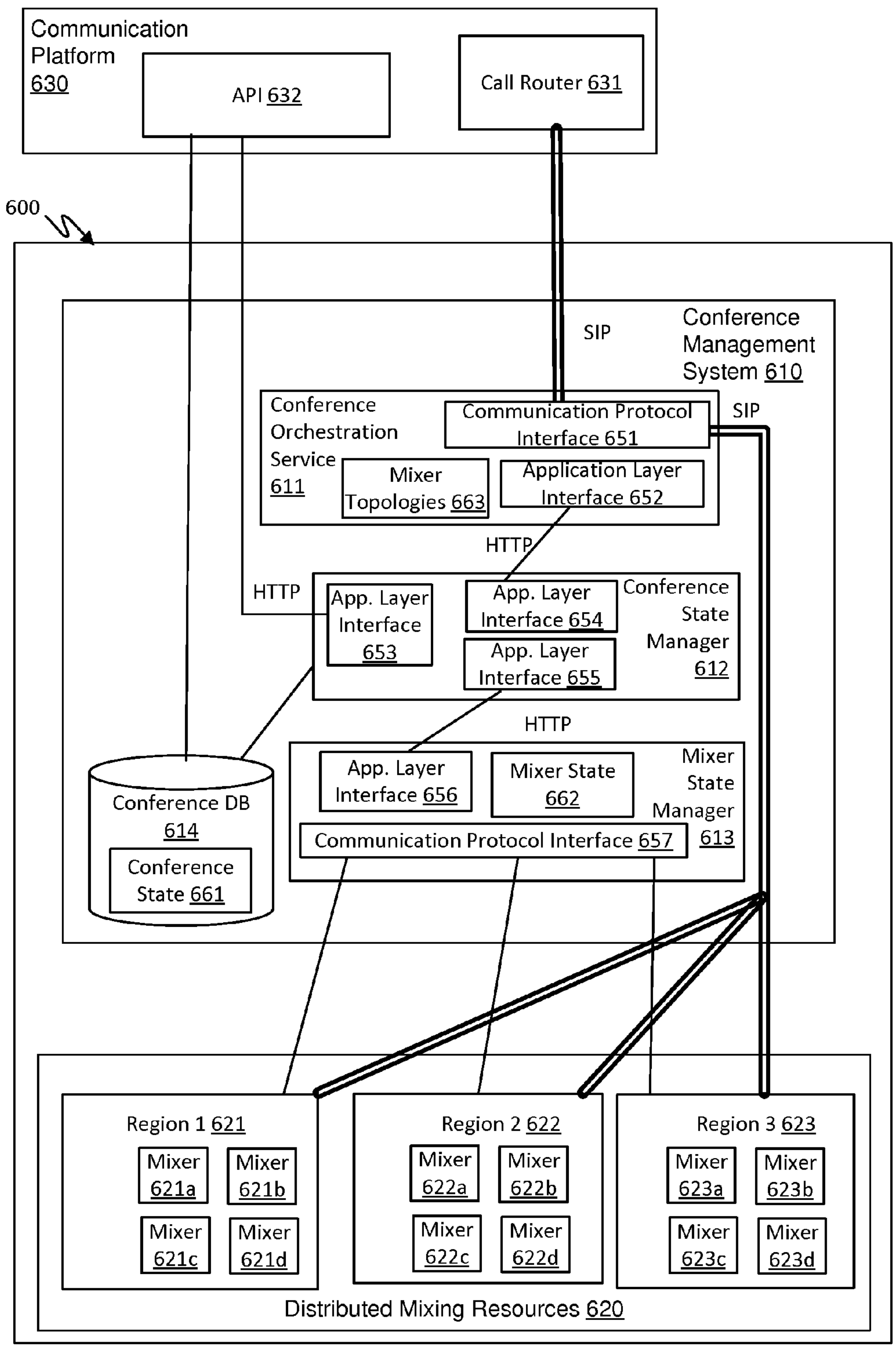

Communication Platform 630
API 632
Call Router 631
600
SIP
Conference Management System 610
Conference Orchestration Service 611
Communication Protocol Interface 651
SIP
Mixer Topologies 663
Application Layer Interface 652
HTTP
HTTP
App. Layer Interface 653
App. Layer Interface 654
App. Layer Interface 655
Conference State Manager 612
HTTP
Conference DB 614
Conference State 661
App. Layer Interface 656
Mixer State 662
Mixer State Manager 613
Communication Protocol Interface 657
Region 1 621
Mixer 621a
Mixer 621b
Mixer 621c
Mixer 621d
Region 2 622
Mixer 622a
Mixer 622b
Mixer 622c
Mixer 622d
Region 3 623
Mixer 623a
Mixer 623b
Mixer 623c
Mixer 623d
Distributed Mixing Resources 620

FIGURE 6

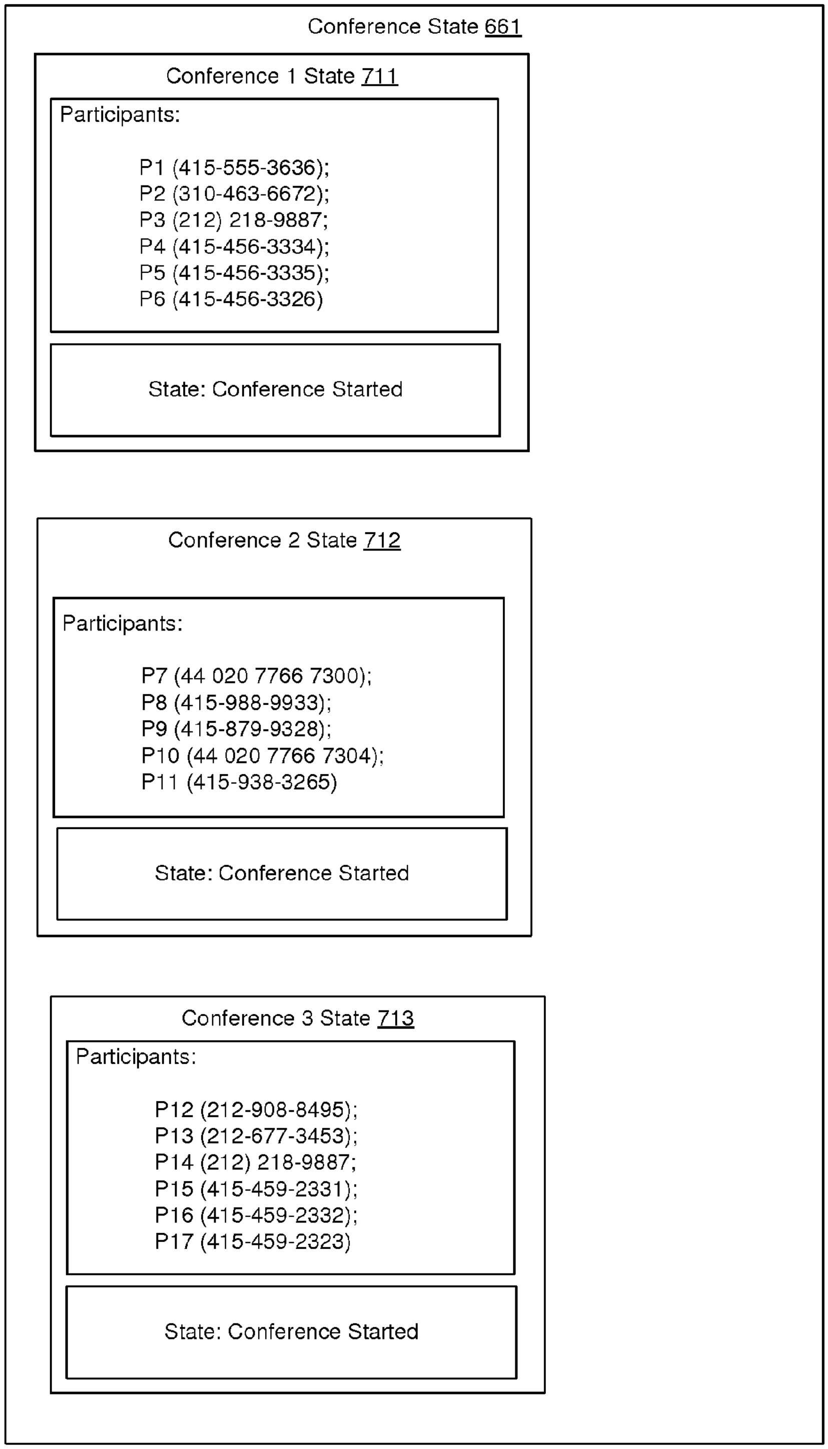

Conference State 661
Conference 1 State 711
Participants:
P1 (415-555-3636);
P2 (310-463-6672);
P3 (212) 218-9887;
P4 (415-456-3334);
P5 (415-456-3335);
P6 (415-456-3326)
State: Conference Started
Conference 2 State 712
Participants:
P7 (44 020 7766 7300);
P8 (415-988-9933);
P9 (415-879-9328);
P10 (44 020 7766 7304);
P11 (415-938-3265)
State: Conference Started
Conference 3 State 713
Participants:
P12 (212-908-8495);
P13 (212-677-3453);
P14 (212) 218-9887;
P15 (415-459-2331);
P16 (415-459-2332);
P17 (415-459-2323)
State: Conference Started

FIGURE 7

662

Mixer ID	Region	Channel IDs of Free Channels	Channel IDs of Used Channels
621a	1 (California, USA)	1,4	2,3,5,6
621b	1 (California, USA)	4	1,2,3,5,6
621c	1 (California, USA)	1,5,6	2,3,4
621d	1 (California, USA)	1,5,6	2,3,4
622a	2 (Virginia, USA)	1,2,3,4,5,6	
622b	2 (Virginia, USA)	1,2,3,4,5,6	
622c	2 (Virginia, USA)	1,2,3,4,5,6	
622d	2 (Virginia, USA)	5,6	1,2,3,4
623a	3 (London, England)	1,5,6	2,3,4
623b	3 (London, England)	1,2,3,4,5,6	
623c	3 (London, England)	1,2,3,4,5,6	
623d	3 (London, England)	1,2,3,4,5,6	

FIGURE 8

Mixer Topology Conference 1 910

Media Source (e.g., Participant, Mixer)	Mixer ID	Mixer Channel ID
P1 (415-555-3636)	621a	2
P2 (310-463-6672)	621a	3
P3 (212) 218-9887	621b	2
P4 (415-456-3334)	621b	3
P5 (415-456-3335)	621c	3
P6 (415-456-3326)	621c	4
Output of Mixer 621a	621b	1
Output of Mixer 621b	621c	2

Mixer Topology Output: Output of Mixer 621c

Mixer Topology Conference 2 920

Media Source (e.g., Participant, Mixer)	Mixer ID	Mixer Channel ID
P7 (44 020 7766 7300)	623a	3
P8 (415-988-9933)	621d	2
P9 (415-879-9328)	621d	3
P10 (44 020 7766 7304)	623a	4
P11 (415-938-3265)	621d	4
Output of Mixer 621d	623a	2

Mixer Topology Output: Output of Mixer 623a

Mixer Topology Conference 3 930

Media Source (e.g., Participant, Mixer)	Mixer ID	Mixer Channel ID
P12 (212-908-8495)	621a	5
P13 (212-677-3453)	621a	6
P14 (212) 218-9887	621b	5
P15 (415-459-2331)	621b	6
P16 (415-459-2332)	622d	3
P17 (415-459-2323)	622d	4
Output of Mixer 621a	622d	1
Output of Mixer 621b	622d	2

Mixer Topology Output: Output of Mixer 622d

FIGURE 9A

Mixer Topology of Conference 1

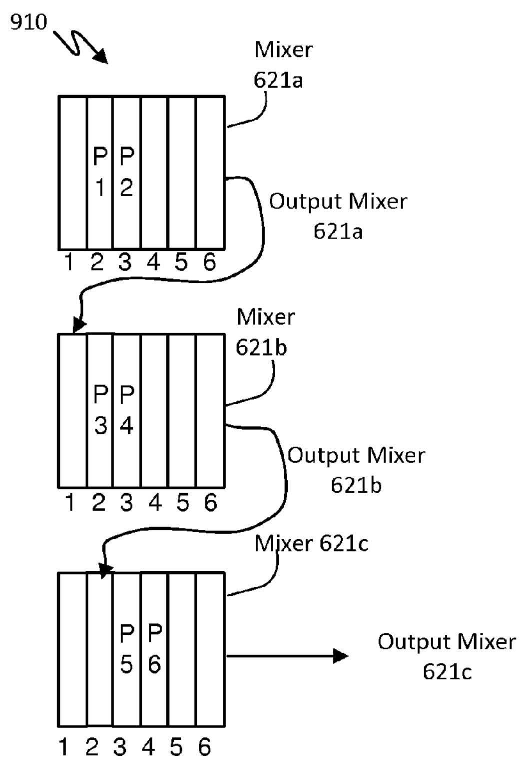


FIGURE 9B

Mixer Topology of Conference 2

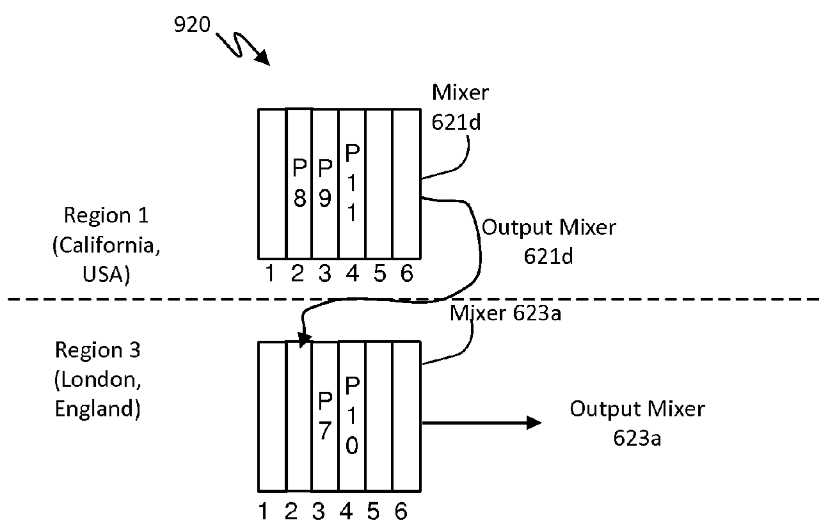


FIGURE 9C

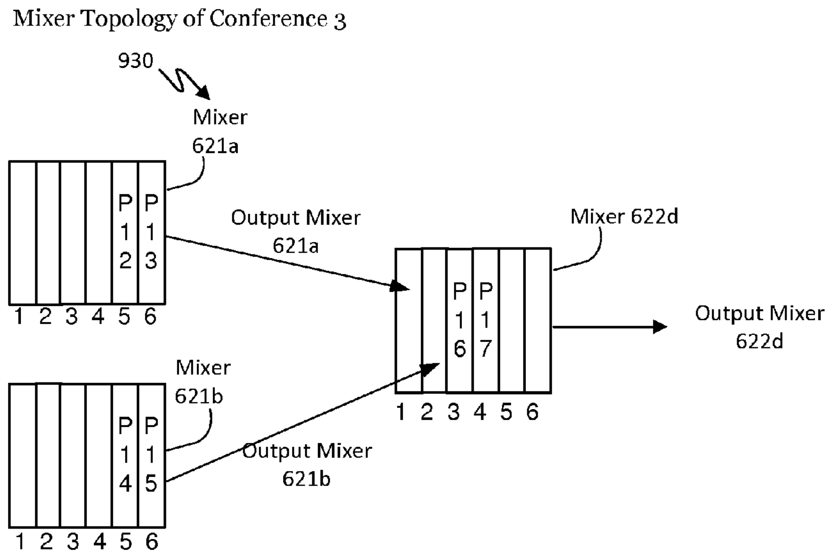

Mixer Topology of Conference 3
930
Mixer
621a
P 1 2
P 1 3
1 2 3 4 5 6
Output Mixer
621a
Mixer 622d
P 1 6
P 1 7
1 2 3 4 5 6
Output Mixer
622d
Mixer
621b
P 1 4
P 1 5
1 2 3 4 5 6
Output Mixer
621b

FIGURE 9D

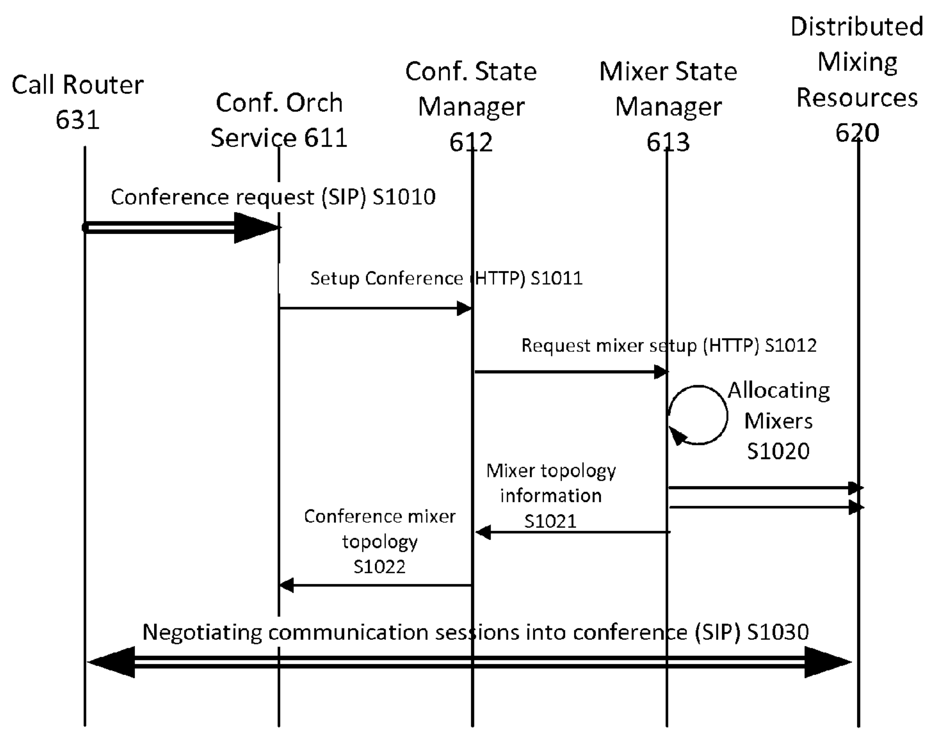
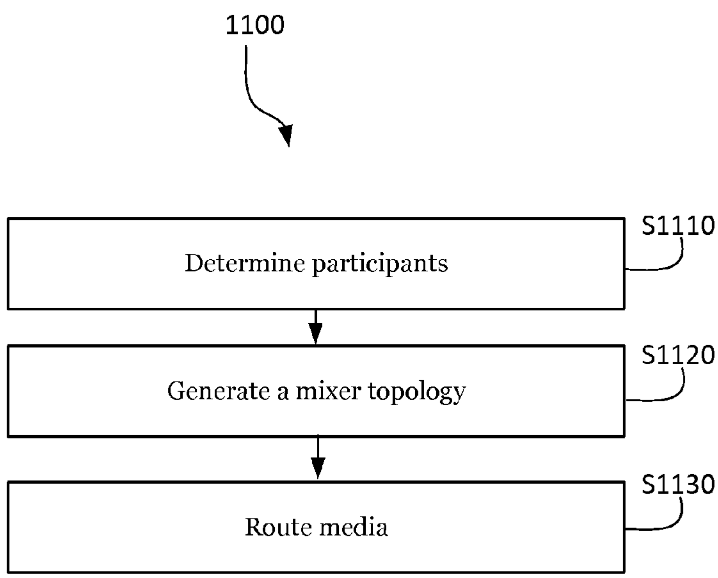

Call Router 631
Conf. Orch Service 611
Conf. State Manager 612
Mixer State Manager 613
Distributed Mixing Resources 620
Conference request (SIP) S1010
Setup Conference (HTTP) S1011
Request mixer setup (HTTP) S1012
Allocating Mixers S1020
Mixer topology information S1021
Conference mixer topology S1022
Negotiating communication sessions into conference (SIP) S1030

FIGURE 10



1100
Determine participants
S1110
Generate a mixer topology
S1120
Route media
S1130

FIGURE 11

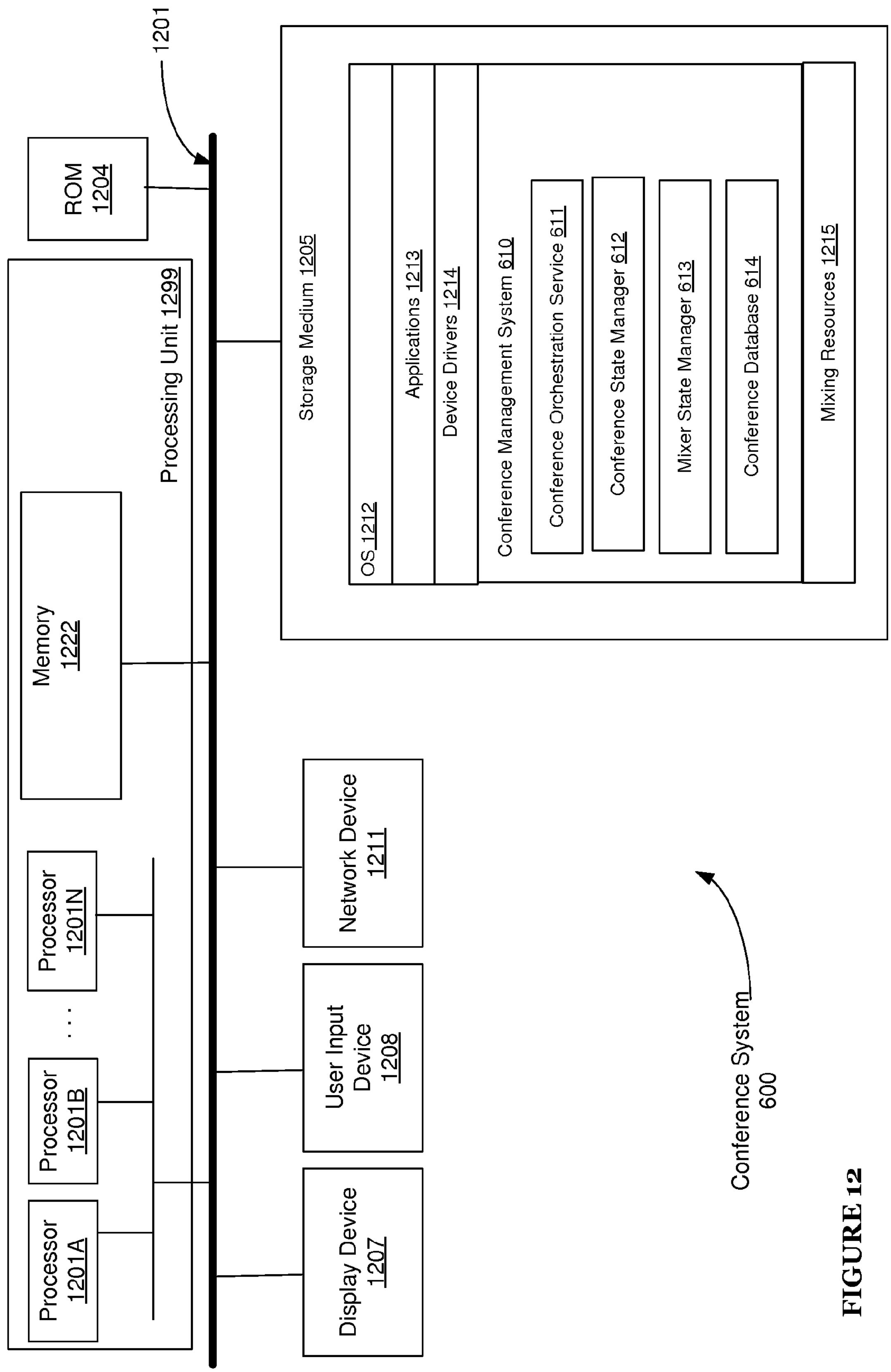

1201
ROM 1204
Processing Unit 1299
Memory 1222
Processor 1201A
Processor 1201B
Processor 1201N
Storage Medium 1205
OS 1212
Applications 1213
Device Drivers 1214
Conference Management System 610
Conference Orchestration Service 611
Conference State Manager 612
Mixer State Manager 613
Conference Database 614
Mixing Resources 1215
Display Device 1207
User Input Device 1208
Network Device 1211
Conference System 600

FIGURE 12

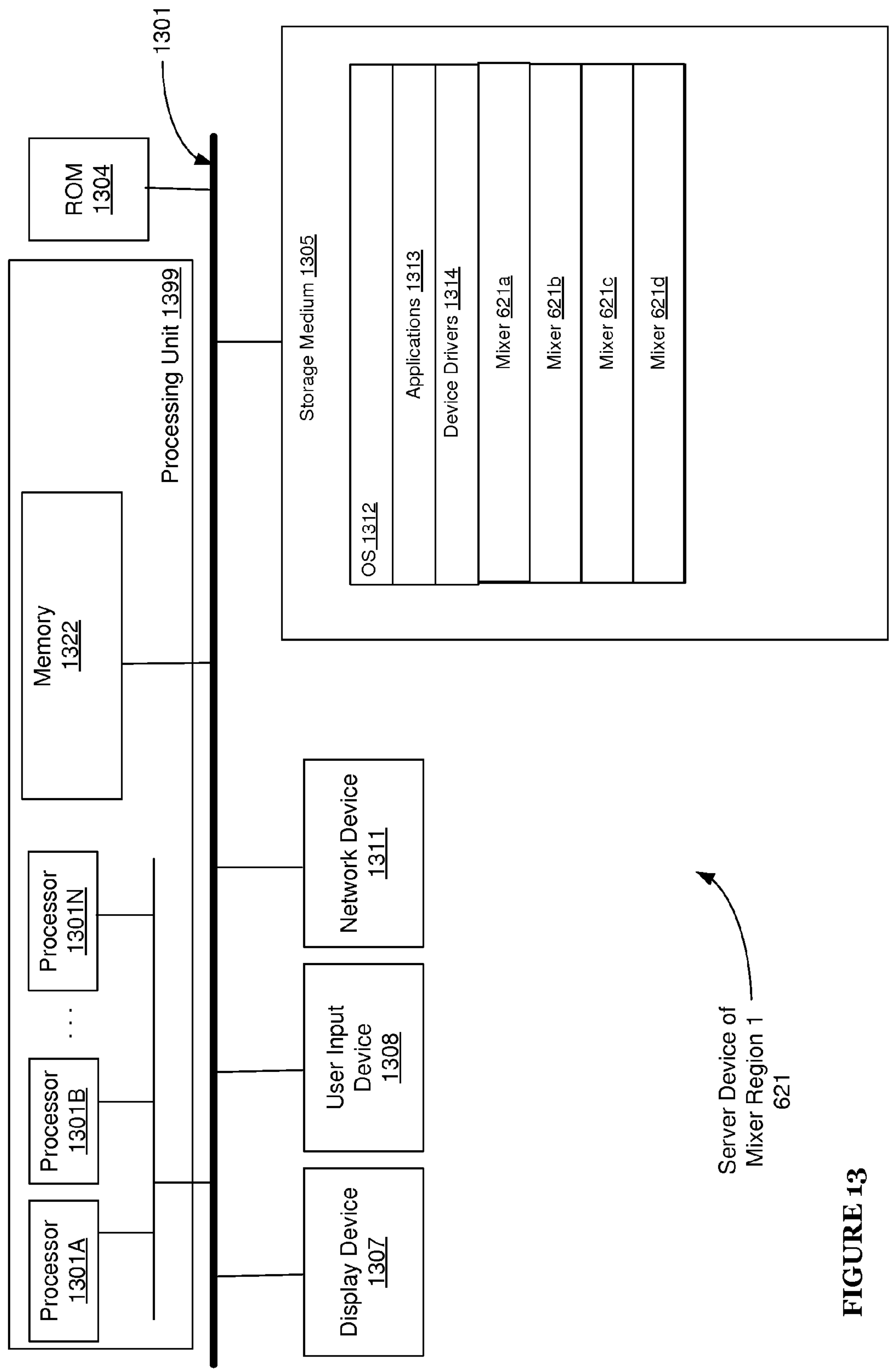

1301
ROM 1304
Processing Unit 1399
Memory 1322
Processor 1301A
Processor 1301B
. . .
Processor 1301N
Storage Medium 1305
OS 1312
Applications 1313
Device Drivers 1314
Mixer 621a
Mixer 621b
Mixer 621c
Mixer 621d
Display Device 1307
User Input Device 1308
Network Device 1311
Server Device of Mixer Region 1 621

FIGURE 13

SYSTEM AND METHOD FOR MANAGING CONFERENCING IN A DISTRIBUTED COMMUNICATION NETWORK

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application Ser. No. 62/021,641, filed on 7 Jul. 2014, which is incorporated in its entirety by this reference.

TECHNICAL FIELD

This invention relates generally to the telephony field, and more specifically to a new and useful system and method for managing conferencing in a distributed communication network.

BACKGROUND

In recent years, innovations in web application and Voice over Internet Protocol (VOIP) have brought about considerable changes to the capabilities offered through traditional phone and communication services. In some distributed or cloud-based telephony systems, the routing of audio, video, or other media files can be determined or limited by the location and/or availability of the appropriate computing resources. In the case of conference calls, the size of the conference, the quality of the media communication, and capability to support all regions can be limited and can be resource prohibitive. In some cases, conferencing systems are replicated in different regions. But such solutions do not solve inter-regional communication issues, and further creates division in infrastructure, which can complicate maintenance and further improvement. Thus, there is a need in the telephony field to create a new and useful system and method for managing conferencing in a distributed communication network. This invention provides such a new and useful system and method.

BRIEF DESCRIPTION OF THE FIGURES

FIG. **1** is schematic representation of a system of a preferred embodiment;

FIG. **2** is a communication sequence diagram of a method of a preferred embodiment;

FIG. **3** is a schematic representation of a variation distributing participants across a series of mixers;

FIG. **4** is a schematic representation of a variation of regionally mixing media;

FIG. **5** is a schematic representation of a variation mixing participants through a hierarchical mixer configuration;

FIG. **6** is schematic representation of a system of a preferred embodiment;

FIG. **7** is a diagram that depicts exemplary conference state;

FIG. **8** is a diagram that depicts exemplary mixer state;

FIGS. **9**A-D are diagrams that depict exemplary mixer topologies;

FIG. **10** is a communication sequence diagram of a method of a preferred embodiment;

FIG. **11** is a process block diagram of a method of a preferred embodiment;

FIG. **12** is an architecture diagram of conference system of a preferred embodiment; and

FIG. **13** is an architecture diagram of mixer system of a preferred embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following description of preferred embodiments of the invention is not intended to limit the invention to these preferred embodiments, but rather to enable any person skilled in the art to make and use this invention.

1. SYSTEM FOR OPERATING SCALABLE CONFERENCING SERVICES

As shown in FIG. **1**, a system **100** for operating scalable conferencing services of a preferred embodiment can include a conference management system **110** and a set of distributed mixing resources **120**. The conference management system preferably no includes a conferencing orchestration service **111**, a conference state manager **112**, and a mixer state manager **113**. The system **100** functions to provide a high quality conferencing system. The system **100** preferably additionally provides regional accessibility, scalability, and efficiency. The system **100** is preferably architected such that communication quality and performance can be high across a wide range of regional areas. The scalability preferably enables the system **100** to scale out to a large number of participants spanning multiple mixer instances as well as supporting multiple distinct conferences. The system **100** efficiency preferably achieves resource usage that can be substantially proportional to the number of participants.

The system **100** is preferably applied in a communication platform (e.g., the communicating platform **130** of FIG. **1**). In one implementation, the system **100** is preferably applied in a communication application platform such as the one described in U.S. Pat. No. 8,306,021 Issued on 6 Nov. 2012, which is hereby incorporated in its entirety by this reference. A communication application platform can execute business logic during a communication session such that a communication state can be directed by application logic and/or API requests. The system **100** is preferably used for synchronous media communication such as voice communication. Voice communication may include communication legs over PSTN, SIP, WebRTC, over the top proprietary IP communications, and/or any suitable communication protocol. Other forms of media such as video may additionally be supplemented or executed using substantially similar systems. For example, audio channels of a video communication session may use the system while individual video media channels are individually routed. In another variation, video may be composited and "mixed" into a single media stream in a manner similar to the audio. Within the communication platform, the communication is preferably divided into media and signaling, and a single communication protocol, such as SIP, may be used for a consistent transport protocol of the signaling within the platform. Other communication protocols may be connected on the edge of the platform or at any suitable location.

In media and signaling protocols, such as SIP, the signaling portion of the communication preferably contributes control directives and a mechanism to communicate various aspects concerning a communication session, and the media portion of the communication is preferably the channel through which media is transferred. The media portion can be particularly susceptible to latency issues caused by the routing path. The signaling route and the media route can diverge in their network topology.

The conference management system **110** preferably functions to control state of the conferencing system **100**. As one aspect of the system **100**, the system **100** is preferably distributed across multiple regional infrastructure systems. Having a physical system presence in different areas can promote higher quality communications. The management is preferably centralized to a single set of resources, but may alternatively be replicated in other regional instances. As mentioned above, the conference management system **110** preferably includes a conferencing orchestration service **111**, a conference state manager **112**, and a mixer state manager **113**. The communication platform may provide other services that function to establish individual communication sessions, which may be connected in or transitioned to a conferencing state at least partially handled by the system **100**. For example a call router (e.g., **131** of FIG. **1**) may facilitate handing incoming calls, making outgoing calls, and controlling communication state (e.g., state as directed by a communication application).

The conferencing orchestration service in of the preferred embodiment functions to orchestrate the conferencing service on a signaling level. The conferencing orchestration service in preferably maintains a communication session model of the conference. The conference orchestration service preferably maintains the signaling dialog with communication services (e.g., the call router **131** of FIG. **1**) of the communication platform (e.g., **130** of FIG. **1**). Requests for a new conference are preferably sent to and established through the conferencing orchestration service **111**. The conferencing orchestration service in preferably has a media/signaling protocol communication interface with the call router (e.g., **131**) or other suitable communication services of the communication platform (e.g., **130**). In one preferred implementation, the conference orchestration service **111** maintains a SIP dialog with a call router (e.g., **131**) and through a back-to-back user agent (B2BUA) mechanism, redirects the back leg of a communication to either the call router (e.g., **131**) or to a mixer channel (e.g., a mixer channel of the distributed mixing resources **120**. Redirecting to a call router (e.g., **131**) may be used to put a communication session into a wait-state by playing a wait song or processing any suitable wait-state application. The conferencing orchestration service **111** is preferably fronted by load balancing mechanism such that any new incoming requests (e.g., SIP INVITES) are distributed to a new server using a round-robin policy.

Individual nodes in the conferencing orchestration service **111** can additionally include an API that enables the conference state manager **112** to notify the conference orchestration service in of state changes. For example, notifications such as "conference starting—please dial in" or "conference ending" or "participant joining/leaving" may be sent through the API. The API is preferably an internal REST API but any suitable API may alternatively be used. The conferencing orchestration service **111** preferably delegates management of conference state to the conference state manager **112**. The conference state manager **112** can then direct the conferencing orchestration service **111** to negotiate media with assigned mixers (e.g., mixers of the distributed mixing resources **120**).

The conference state manager **112** of the preferred embodiment functions to manage the state of the conferences in a highly available manner. The state of conferences is preferably global across multiple communication platform regions. The conference state may reference conference participants and mixers in different regions. The conference state manager **112** preferably maintains an application model of a conference. The conference state **112** manager preferably stores a data object representation of a conference. The data model of a conference may include a list of participants, duration of the conference, and state of the conference (e.g., waiting for participants, in session, completed, and the like). The conference state manager preferably **112** includes an interface to an Application Program Interface (API) (e.g, the API **132**) of the communication platform (e.g., **130**), which may be an access point for programmatically inspecting and/or modifying the state of a conference. The conference state manager **112** preferably includes application layer communication interfaces to the API (e.g., **132**), the conference orchestration service **111**, and the mixer state manager **113**. The application layer communication interfaces preferably use HTTP/S, but may alternatively use any suitable application layer protocol. The conference state manager **112** can relay changes in state of a conference to the conference orchestration service in, which can make suitable changes to the managed media services. The conference state manager **112** additionally utilizes the mixer state manager **113** to setup and determine mixer setup for a given conference. The conference state manager **112** may be fronted by a load balancer.

The mixer state manager **113** of the preferred embodiment functions to monitor and control the set of mixer resources (e.g., mixer resources of the distributed mixing resources **120**). The set of mixers may be distributed across multiple regions (e.g., "Region **1**", "Region **2**", and "Region **3**" of FIG. **1**), and each regional set of mixers may have various amounts of mixing capacity and number of running instances. Additionally, each mixer may be in different states depending on whether the mixer is serving a conference, multiple conferences, or idle. The mixer state manager **113** preferably manages a data model of the mixer resources. The mixer state manager **113** may store the mixer state information across a distributed storage system such that access to the information is highly available. As described above, an application layer communication interface preferably exists between the conference state manager **112** and the mixer state manager **113**. The mixer state manager **113** additionally include a communication control protocol interface with the set of mixers (e.g., mixers of the distributing mixing resources **120**), such as SIP or at least some signaling portion of a media and signaling protocol. The mixer state manager **113** is preferably configured to be responsive to requests of the conference state manager **112**. The mixer state manager **113** can provide information about the current state of mixers (e.g., mixers of the distributing mixing resources **120**) and additionally allocate mixers. The mixer state manager **113** can assign participants to particular mixers. The mixer state manager **113** can preferably apply regional and quality based heuristics in assigning mixers. Additionally, the mixer state manager **113** can additionally consider the distribution of participants according to the partitions of a mixer instance. A mixer may fail at times, and the mixer state manager **113** can detect the mixer failure for a conference session, allocate a new mixer, and re-invite participants to recover from the failure.

The set of mixers (e.g., mixers of the distributing mixing resources **120**) of the preferred embodiment functions to provide a set of resources that can merge, bridge, or otherwise combine media streams to allow multiple legs in a communication. There is preferably a plurality of mixer instances in the set of mixers. The set of mixers may additionally be distributed across distinct regional areas. A subset of mixers can exist in a first region (e.g., "Region **1**" of FIG. **1**) and a second subset of mixers can exist in a second region (e.g., "Region **2**" of FIG. **1**). A region preferably describes distinct computer cluster location where a set of resources of the communication platform is instantiated. For example, a first region may exist on the West coast while a second region exists in the East cost. As media may be sensitive to latency from routing between regions, a set of regional subsystems can facilitate improving communication quality and in particular reducing media latency.

Mixers can preferably be used in isolation for a conference—one mixer facilitates completing mixing for every participant in a conference. Alternatively, mixers may be used in combination to facilitate mixing for all participants. Mixers may be used in series. For example, a first mixer may mix three of the eight participants in a conference, a second mixer may mix another three, and a third may mix two remaining participants. The three mixers are preferably set to be bridged for those partitions so that all eight participants are appropriately mixed. The mixers may be arranged in a hierarchical or network formation. For example, two mixers may mix media streams of participants, and the output media stream from each of these two child mixers can be mixed by a parent mixer. Such mixing architecture can be used to flexibly use the capacity of the mixing resources.

The system (e.g., **100**) of the preferred embodiment is preferably operable in at least two regions, which are connectable through the media resources of the system. Various provider services in the regions can facilitate connecting media streams to outside endpoints (e.g., PSTN phones, SIP phones, or IP communication devices). The regions are preferably selected to serve endpoints local to that region. The regions may be separated by globally significant distance. A globally significant distance in this document may be understood to be a transmission distance greater than 2000 miles and more preferably greater than 5000 miles. For example, the first region may be on the West coast of the US and the second region may be on the East coast, separated by a geographic distance greater than 2500 miles. In another example, the first region may be in the United States and the second region may be in Europe, separated by a distance greater than 3500 miles. The first region and the second region are not limited to functioning with such distance ranges and may be separated by a distance less than 2000 miles or exceeding 5000 miles.

A mixer (e.g., a mixer of mixing resources **120**) of a preferred embodiment functions to mix or combine at least two sources of synchronous communication. In particular, audio media streams are combined into a single audio stream. A mixer is preferably a service that includes a communication interface and processing capabilities. In one preferred implementation, the communication interface is an SIP interface, which may be used in interfacing with the communication orchestration service in, other mixers in the same region, mixers in other regions, and/or other communication resources such as recording services, and communication gateways (which may connect to destination endpoints).

The mixer may have a participant input capacity, which limits the number of participants that can be mixed. The mixer preferably includes a number of participant input channels. For example, a mixer may be able to handle up to 500 participants. The number of participant input channels can additionally be distributed across distinct conference sessions, such that one mixer instance can serve multiple conferences. A mixer preferably outputs mixed media, which may be directed to endpoint connections and/or other mixers. A mixer preferably has an identifier such that media can be directed to specific mixers as assigned by the mixer state manager **113**. Various other capabilities may be built into a mixer. The mixers may additionally include media mixing capability that allows a manager to listen to a participant leg (i.e., the manager is a silent participant). Additionally, the mixer may include mixing capability to segment portions of audio to subset of participants. For example, one participant may be able to privately converse with one other participant without other participants hearing their conversation.

The system (e.g., **100**) can include resources or functionality modules that can provide recording, transcription, text-to-speech services, DTMF input, speaker identification service (e.g., which participant is speaking when), or any suitable media service.

2. METHOD FOR OPERATING SCALABLE CONFERENCING SERVICES

As shown in FIG. **2**, a method for operating scalable conferencing services of a preferred embodiment can include receiving a request for a new conference S**110**, allocating mixers of the conference S**120**, and negotiating media across the allocated mixers S**130**. More specifically, a mixer topology is created according to regional associations and restrictions. Then when negotiating media across the allocated mixers, participants are allocated to input channels of a mixer and mixers are bridged to form a determined mixer topology.

The method functions to provide a high quality conferencing service. The method may additionally promote regional accessibility, scalability, and efficiency. The scalability preferably enables the method to facilitate conferences with a large number of participants, spanning multiple mixer instances, as well as supporting multiple distinct conferences. The system efficiency preferably achieves resource usage that can be substantially proportional to the number of participants. The method is preferably implemented by the system (e.g., **100**) described above, but may alternatively be implemented by any suitable system.

The method may be applied in a variety of conferencing scenarios. The method preferably accounts for different scaling and allocation scenarios so as to provide high capacity and high quality conferencing. The method can be used in conferencing scenarios such as when the participants are geographically distributed, where the conference is not started until all participants join, where a conference can organically grow without a priori knowledge of the identity or number of participants, and other suitable scenarios.

Block S**110**, which includes receiving a request for a new conference, functions to receive some directive to create a conference. The request can be part of an asynchronous API request. The request may alternatively be a response to the routing of communication. For example, a communication session may hit a conference orchestration service (e.g., in of FIG. **1**) and be placed in a conference. While an endpoint and corresponding communication session is waiting to join a conference session, the communication session may be directed to a wait-state application which can play music, execute an application, or perform any suitable application logic. The communication session is preferably transferred into an active communication session during block S**130**.

Block S**110**, preferably includes determining participants of the conference. Participants may be present on an existing or otherwise established communication session. For example, a caller may be transferred into a conference. As another example, a caller may dial in to a phone number or other suitable endpoint, which is mapped to a particular conference. A conference state manager (e.g., **112** of FIG. **1**) preferably manages the conference participants. In one case, participants may be specified through an API (e.g., the API **132** of FIG. **1**). The API calls are preferably directed to the conference state manager (e.g., **112**) such that state can be updated. In some cases, a participant may not be present in an active communication session. The method can include making an outgoing communication request to establish a communication session with the missing participant such that the participant can be added to a conference. In some cases, the conference waits for some initiating condition such as a conference start time, threshold number of participants, or any suitable condition. In other cases, a conference session can begin as soon as the conference is created.

In addition to determining participants, the method preferably includes determining participant regions. The conferencing infrastructure may be distributed across various regions. Geographic proximity to a region may improve communication quality. The regions associated with a participant may be completed through processing an endpoint. In some cases, endpoints (such as telephone numbers) will include location-overloaded information (e.g., country/area codes). Alternatively, location information may be collected and obtained through any suitable method or source.

Block S**120**, which includes allocating mixers (e.g., mixers of the distributed mixing resources **120** of FIG. **1**) of the conference, functions to setup mixers to handle the conferences session. Allocating mixers preferably includes determining which mixers, and specifically which participant will be assigned to which input channel of a mixer. Additionally, a multi-mixer topology can be created which defines bridging of media between mixers. The mixer state manager **113** preferably stores state of the set of mixers. Mixers may be in different states of usage. In some cases allocating mixers may involve adding mixers in one or more regions. Mixers can additionally be removed from the set of mixers. As another variation, allocating mixers can involve transitioning an existing conference in response to the mixing requirements introduced. Such responsive changes to conference mixing function to improve overall communication quality across multiple conferences.

Allocating mixers (block S**120**) preferably includes processing the information related to the conference and generating a mixer topology. Generating a mixer topology preferably calculates an arrangement/architecture to mixer assignment and bridging so as to obtain high quality communication. The mixer topology preferably characterizes and identifies how the media from participants is mixed to form a conferencing experience. With the mixer resources described above, a participant is preferably mapped to one particular media input channel. The mixer topology can be generated according to some operational goal. Preferably the goal is communication quality. High quality communication is preferably a function of communication latency, which is preferably minimized or reduced. Other properties that may additionally or alternatively be factored into the evaluation function of communication quality can include packet loss, post dial delay (PDD) (i.e., time for carrier to indicate the other side is ringing), monetary cost to the platform provider, monetary price charged to account holder, media quality, and/or any suitable factor. Generating a mixer topology can additionally account for mixer capacity. Additionally, how multiple mixers can be bridged may additionally be determined.

The mixer topology can consider various factors and may include heuristics for particular scenarios. In one variation, block S**120** can include grouping participants into mixer input channels according to regional association. More specifically, the orchestration of mixers may be such that the conference achieves local media communication quality. In other words, participants local to other participants experience improved communication quality. For example, if a conference exists by a group of 3 participants in the West coast and 4 in the East coast, then a set of mixers in a Western region handle the first set of participants and a set of mixers in the Eastern region handle locally conferencing the second set of participants. Communication quality may be of lower quality between the participants in the two regions, but conferencing between the local participants may have high quality communication.

In another variation, block S**120** can include grouping participants into mixer partitions by participant priority. Participants may be marked by different priority. The priority may be based on who organized the meeting, the role in the conference, or any suitable property. For example, a massive conference may have a host/moderator, a panel (who will contribute to the discussion), and then audience members who may be silent participants but may be allowed to ask questions at times. Mixing topology generation can weigh the priority of participants when calculating conference quality. For example, participants that will primarily be listening may not have a high demand for low latency communication, and so the mixer topology may not optimize for minimizing media latency for these participants.

Block S**130**, which includes negotiating routing media of the set of communication sessions to the allocated mixers, functions to route media of participants to assigned mixers and start the conferencing session. Negotiation routing media preferably includes various signaling handshaking between involved media resources and the mixer resources. The media is preferably routed according to the mixer topology which can include routing media of participants to assigned mixer input channel and bridging mixed media across mixer instances. As described above, SIP or an alternative media and signaling protocol may be used in directing participant communication sessions from a conference orchestration service **111** to mixers. In particular, the media of the participant communication session is routed to a mixer. Intermediary nodes may be used in the routing to mixer. For example, regional gateway proxy servers may be used when routing media or signaling to outside regions. Within a mixer, the set of participant input channels for a conference are mixed or combined through any suitable processing. The output of the mixing can be bridged to another mixer for further mixing or redirected to a connected endpoint.

Negotiating the routing of media preferably establishes various mixer scenarios. In a first variation, the participants may be serviced by a single mixer. A single mixer may be used when all participants have relatively close proximity to the mixer, and a mixer has capacity to handle the number of participants.

In other instances, multiple mixers may be used. In one use-case, a single mixer may not have capacity for a conference, and so the participants are distributed across multiple mixers as shown in FIG. **3**. In another use-case, multiple mixers may be used so as to give a subset of participants regional mixing within the conference as shown in FIG. **4**. The mixers preferably bridge over to other mixers such that a mixer output channel is mixed as an input to a second mixer.

In yet another instance, mixers may be used in a hierarchical mixing. In hierarchical mixing a mixer mixes output channels of at least two mixers as shown in FIG. **5**. Participant input channels can additionally be mixed simultaneously with hierarchical mixing.

Once negotiated, a conference session can take place, and participants can communicate as a group. Various features may additionally be supported during a conference.

A conference is preferably exposed as an accessible API resource, and as such, the conference can preferably be manipulated through various directives. The state of the conference can be queried. Information such as conference status (e.g., waiting, started, ended), participant count, participant identification, conference duration, an event log of the conference (e.g., when people joined/left, who spoken when, etc.), and other suitable pieces of information can be supplied in an API response. Additionally the conference may be augmented. API calls directed at a particular conference may add or remove participants, mute participants, set up individually directed media control, split a conference into multiple conferences, join a conference with another conference, end the conference, and/or make any suitable change.

A method can additionally include individually directing the media flow of one or more participants. With individual media control in addition to the group mixing, participants may be able to listen in on a second participant. As an exemplary use case, a manager may want the capability to listen in on a participant's leg of the conference. As another variation, a participant may want the capability to transfer media to only a subset of participants. For example, during a conference, a first participant may want to say something to a second participant without the other participants hearing what is said. As another example, the first participant may want to say something to a larger subset of participants (e.g., two or more people) without the rest hearing.

Event callbacks can additionally be configured for the conference. An event callback is preferably a mapping between an event and a designated callback destination such as an URI or other resource that is accessed when the event is detected. A callback destination may also be a pre-established application session using web-sockets or some other similar mechanism. In particular, a speaker callback, may be triggered when a speaker changes in the conference. For example, an application that setup the conference may set a speaker callback URI. When a speaker changes in the conference, an HTTP messages is sent to the speaker callback URI. The message preferably identifies the new speaker and optionally the time of the change and the last speaker. Another callback may be for communication input. In telephony conferences, participants may be able to provide input through DTMF input. An input callback will preferably hit the input callback resource with information about input (e.g., who entered what key when). Other callbacks can include when the conference starts, when the conference ends, when there is a change in the participants (e.g., a new one joins or leaves), or any suitable event.

The method can additionally include transitioning mixer topology, which functions to adapt negotiated mixer topology according to new conditions. Participants can join and leave during a conference, and as such the preferred mixer topology can change. The transition can be in response to any number of triggers. In one variation, the mixer topology may be re-evaluated and possibly transitioned each time there is a change in participants. This may provide high quality communication throughout a conference. In another variation, the conference may be re-evaluated periodically, which may avoid overhead of frequent transitions but allow communication to be eventually transitioned to a preferred state. In another variation, the transitioning may be re-evaluated and initiated in response to a trigger. For example, a user input may signal that the communication quality is lacking, and should be refreshed to improve quality. Other variations may include variations more directed at changes in regional mixing, or the number of participant changes, total number of participants, and other factors.

The method described above was directed towards a single conference instance, but the system and method is preferably used in situations where multiple conferences are facilitated simultaneously. More preferably, the method is used to service the conferencing features of a multi-tenant communication platform. The selection of mixers additionally considers the usage of mixers across multiple mixers.

3. CONFERENCE SYSTEM

As shown in FIG. **6**, a conference system **600**, in accordance with an embodiment, includes a conference management system **610** and distributed mixing resources **620**. In some implementations, the conference management system **610** includes a conference orchestration service **611**, a conference state manager **612**, a mixer state manager **613**, and a conference database **614**.

In some implementations, the conference management system **610** is similar to the conference management system **110** of FIG. **1**. In some implementations, the distributed mixing resources **620** is similar to the distributed mixing resources **120** of FIG. **1**. In some implementations, the conference orchestration service **611** is similar to the conference orchestration service in of FIG. **1**. In some implementations, the conference state manager **612** is similar to the conference state manager **112** of FIG. **1**. In some implementations, the mixer state manager **613** is similar to the mixer state manager **113** of FIG. **1**. In some implementations, the conference database **614** is similar to the conference database **114** of FIG. **1**.

In some implementations each mixer (e.g., **621***a-d*, **622***a-d*, **623***a-d*) is a mixer system. In some implementations each mixer system is a server device (e.g., a server device similar to the server device of FIG. **13**). In some implementations the mixers (e.g., **621***a-d*, **622***a-d*, **623***a-d*) are included in a server device. In some implementations the mixers are included in a plurality of server devices. In some implementations, each mixer (e.g., **621***a-d*, **622***a-d*, **623***a-d*) includes at least one processing unit (e.g., a processing unit similar to the processing units described below for FIG. **13**, such as, for example, the processing unit **1399**). In some implementations, mixers in a same region are included in a same server device. For example, the mixers **621***a-d* are included in a first server device located in Region **1** (e.g., California, USA), the mixers **622***a-d* are included in a second server device located in Region **2** (e.g., Virginia, USA), and the mixers **623***a-d* are included in a third server device located in Region **3** (e.g., London, England). In some implementations, mixers in a same region are included in a same computing cluster (e.g., a computing cluster that includes a plurality of computing devices, such as, for example, a server device similar to the server device of FIG. **13**). For example, the mixers **621***a-d* are included in a first computing cluster located in Region **1** (e.g., California, USA), the mixers **622***a-d* are included in a second computing cluster located in Region **2** (e.g., Virginia, USA), and the mixers **623***a-d* are included in a third computing cluster located in Region **3** (e.g., London, England). In some implementations, each server device includes at least one processing unit (e.g., a processing unit similar to the processing units described below for FIG. **13**, such as, for example, the processing unit **1399**).

In some implementations, the conference management system **610** is included in a server device (e.g., the server device of FIG. **12**). In some implementations, the conference management system **610** is included in a server device (e.g., the server device of FIG. **12**), and the conference management system **610** includes at least one mixer (e.g., at least one of the mixers **621***a-d*, **622***a-d*, **623***a-d*). In some implementations, the conference management system **610** is included in a server device (e.g., the server device of FIG. **12**), and the conference management system **610** includes mixers of at least one region (e.g., mixers of at least one of "Region **1**", "Region **2**", and "Region **3**) of FIG. **6**.

In some implementations, the conference management system **610** is a distributed system that includes a plurality of server devices. In some implementations, the conference management system **610** includes at least one mixer (e.g., at least one of the mixers **621***a-d*, **622***a-d*, **623***a-d*). In some implementations, the conference management system **610** includes mixers of at least one region (e.g., mixers of at least one of "Region **1**", "Region **2**", and "Region **3**) of FIG. **6**.

In some implementations, each of the regions of the distributed mixing resources **620** (e.g., "Region **1**", "Region **2**", and "Region **3**) are communicatively coupled via media resources of the system **600**. In some implementations, various provider services in the regions facilitate coupling media streams to outside endpoints (e.g., PSTN phones, SIP phones, or IP communication devices). In some implementations, the regions are selected to serve endpoints local to that region. In some implementations, the regions are separated by a globally significant distance. In some implementations, a globally significant distance is a transmission distance greater than 2000 miles. In some implementations, a globally significant distance is a transmission distance greater than 5000 miles. In some implementations, for example, a first region may be on the West coast of the US (e.g., California, USA) and a second region may be on the East coast (e.g., Virginia, USA), separated by a geographic distance greater than 2500 miles. In some implementations, for example, a first region may be in the United States (e.g., Virginia, USA) and a second region may be in Europe (e.g., London, England), separated by a distance greater than 3500 miles. In some implementations, the first region and the second region are not limited to functioning with such distance ranges and may be separated by a distance less than 2000 miles or exceeding 5000 miles.

In some implementations, the conference orchestration service **611**, the conference state manager **612**, the mixer state manager **613**, and the conference database **614** are included in a single server device (e.g., the server device of FIG. **12**). In some implementations, the conference orchestration service **611**, the conference state manager **612**, the mixer state manager **613**, and the conference database **614** are included in a distributed computing system that includes a plurality of server devices, and each server device of the distributed computing system includes one or more of the conference orchestration service **611**, the conference state manager **612**, the mixer state manager **613**, and the conference database **614**.

In the embodiment of FIG. **6**, the conference system **600** is communicatively coupled to a communication platform **630**. In some implementations, the communication platform **630** is similar to the communication platform **130** of FIG. **1**. In some implementations, the communication platform **630** includes an API **632** and a call router **631**. In some implementations, the API **632** is similar to the API **132** of FIG. **1**. In some implementations, the call router **631** is similar to the call router **131** of FIG. **1**.

As shown in FIG. **6**, the conference orchestration service **611** is communicatively coupled to the call router **631** via a communication protocol interface **651**, and the conference state manager **612** is communicatively coupled to the API **632** via an application layer interface **653**. As shown in FIG. **6**, the conference database **614** is communicatively coupled with the API **632**.

As shown in FIG. **6**, the communication protocol interface **651** communicatively couples the conference orchestration service **611** to at least one mixer of the distributed mixing resources **620**.

As shown in FIG. **6**, an application layer interface **652** communicatively couples the conference orchestration service **611** to an application layer interface **654** of the conference state manager **612**.

As shown in FIG. **6**, the conference state manager **612** is communicatively coupled to the conference database **614**.

As shown in FIG. **6**, an application layer interface **655** communicatively couples the conference state manager **612** to an application layer interface **656** of the mixer state manager **613**.

As shown in FIG. **6**, a communication protocol interface **657** communicatively couples the mixer state manager **613** to at least one mixer of the distributed mixing resources **620**.

In some implementations, the communication protocol of at least one of the interfaces **651** and **657** is SIP (Session Initiation Protocol). In some implementations, the application layer interface of at least one of the interfaces **652**, **653**, **654**, **655**, and **656** is an HTTP interface.

In some implementations, the conference database **614** includes conference state **661**. In some implementations, the conference state manager includes the conference state (e.g., **661**). In some implementations, the conference state **661** includes conference state for each conference of the system **600**. In some implementations, the conference state for a conference is generated during reception of a request for a new conference. In some implementations, conference state for a conference indicates at least each participant of the conference. In some implementations, conference state for a conference indicates at least an endpoint identifier (e.g., a telephone number) for each participant of the conference.

FIG. **7** depicts exemplary conference state of the conference state **661**.

In some implementations, the mixer state manager **613** includes mixer state **662**. In some implementations, the mixer state **661** includes mixer state for each mixer of the distributed mixer resources **620** (e.g., the mixers **621***a-d*, **622***a-d*, **623***a-d*) of the system **600**. In some implementations, the mixer state for a conference is managed by the mixer state manager **613** during operation of each mixer of the distributed mixer resources **620**. In some implementations, mixer state for a mixer indicates at least a status of each channel of the mixer. In some implementations, the status indicates whether the respective channel is in use or not in use. In some implementations, the status indicates that the channel is not in use in a case where the channel is not in use, and indicates at least one of participant identifier and a conference identifier in a case where the channel is assigned to a participant of a conference. In some implementations, a participant identifier is an endpoint identifier (e.g., a telephone number).

FIG. **8** depicts exemplary mixer state of the mixer state **662**.

In some implementations, the conference orchestration service **611** includes mixer topologies **663**. In some implementations, the mixer topologies **663** includes a mixer topology for each conference for which at least one mixer is allocated. In some implementations, each mixer topology specifies an assignment of each participant of a respective conference to at least one input channel of a mixer. In some implementations, each assignment of a mixer topology indicates an endpoint identifier (e.g., a telephone number) and a corresponding mixer channel identifier (e.g., a mixer ID and a corresponding mixer channel ID). In some implementations, a mixer topology for a conference identifies a mixer output to be provided to the conference orchestration service **611**. For example, in a case of a mixer topology that includes more than one mixer, the mixer topology indicates the mixer whose output is provided to the conference orchestration service as the output of the mixer topology.

FIGS. **9**A-D depict exemplary mixer topologies of the mixer topologies **663**. FIG. **9**A depicts exemplary data representations of mixer topologies of Conference **1**, Conference **2**, and Conference **3** of the exemplary conference state information **661** of FIG. **7**. FIG. **9**B is a diagram representing the mixer topology of Conference **1** state **711**. FIG. **9**C is a diagram representing the mixer topology of Conference **2** state **712**. FIG. **9**D is a diagram representing the mixer topology of Conference **3** state **713**.

The exemplary mixer state **662** of FIG. **8** represents the mixer state of the mixers (e.g., of the distributed mixing resources **620**) after allocation of mixer channels in accordance with the mixer topologies of FIGS. **9**A-D.

In some implementations, the conference state manager **612** is constructed to maintain conference state (e.g., conference state **661**) of each conference, and to notify the conference orchestration service **611** of conference state changes via the application layer communication interfaces **654** and **652**.

4. METHOD OF FIG. 10

The method **1000** of FIG. **10** includes, at a conferencing system (e.g., **600** of FIG. **6**) constructed to operate scalable conferencing services, the conferencing system including a conference orchestration service (e.g., **611**), a conference state manager (e.g., **612**), a mixer state manager (e.g., **613**), and a set of distributed mixers (e.g., **620**): receiving a request for a new conference via at least one of an application layer interface (e.g., **653**) of the conferencing system and a signaling protocol communication interface (e.g., **651**) of the conference orchestration service (e.g., **611**) (process S**1010**); allocating mixers (e.g., mixers **621**_a-d_, **622**_a-d_, **623**_a-d_ of FIG. **6**) of the conference, the mixers being mixers of the set of distributed mixers (e.g., **6200**) (process S**1010**), and negotiating media across the allocated mixers (process S**1030**). Receiving a request for a new conference includes determining participants of the conference. Allocating mixers of the conference includes generating a mixer topology that specifies an assignment of each determined participant to at least one input channel of at least one mixer of the set of distributed mixers. Negotiating media across the allocated mixers includes routing media of each determined participant to the assigned at least one input channel, and starting the conference. The media is routed according to the generated mixer topology. The mixer state manager (e.g., **613**) generates the topology responsive to an application layer request provided by the conference state manager (e.g., **612**), the conference state manager provides the application layer request responsive to an application layer request provided by the conference orchestration service (e.g., **611**), the routing is performed by the conference orchestration service in accordance with a signaling protocol, and the conference orchestration service receives the generated mixer topology from the mixer state manager via the conference state manager.

In some implementations, the generated mixer topology is stored by the mixer state manager. In some implementations, the generated mixer topology is stored at the mixer state manager. In some implementations, the generated mixer topology is stored at a storage medium (e.g., **1205** of FIG. **12**) of the system **600**.

In some implementations, the system **600** performs the processes **S1010-S1030**. In some implementations, the conference orchestration service **611** (of FIG. **6**) performs the process S**1010**. In some implementations, the mixer state manager **613** (of FIG. **6**) performs the process S**1020**. In some implementations, the conference orchestration service **611** (of FIG. **6**) performs the process S**1030**.

In some implementations, the process S**1010** is similar to the process S**1010** of FIG. **2**. In some implementations, the process S**1020** is similar to the process S**120** of FIG. **2**. In some implementations, the process S**1030** is similar to the process S**130** of FIG. **2**.

4.1 Receiving a Request for a New Conference

In some implementations, the process S**1010** functions to control the system **600** to receive a request for a new conference via at least one of an application layer interface (e.g., **653**) of the conferencing system and a signaling protocol communication interface (e.g., **651**) of the conference orchestration service (e.g., **611**). In some implementations, the communication interface **651** of the conference orchestration service **611** receives a request for a new conference from a call router (e.g., the call router **631** of the communication platform **630**). In some implementations, the interface **651** is a SIP interface and the request for a new conference is a SIP request. In some implementations, the application layer interface **653** of the conference state manager **612** receives a request for a new conference via an API request (e.g., of the API **632** of the communication platform **630**). In some implementations, the interface **653** is an HTTP interface. In some implementations, the interface **653** is REST application program interface (API).

In some implementations, the process S**1010** includes determining participants of the conference, as described above for S**110** of FIG. **2**. In some implementations, the conference state manager **612** manages conference state of the conference (e.g., the conference state **661**), and the conference state (e.g., **661**) indicates participants of the conference (e.g., as shown in FIG. **7**). In some implementations, the conference state (e.g., **661**) is stored by the conference database **614**. In some implementations, the participants of the conference are specified by an API call received by the system **600**. In some implementations, the participants of the conference are specified by an API call received by the application layer interface **653** of the conference state manager **612**. In some implementations, each participant of the conference is identified by an endpoint identifier (e.g., a telephone number). In some implementations, the participants of the conference are specified by at least one conference request (e.g., a SIP request) received by the conference orchestration service **611** via the communication protocol interface **651**.

In some implementations participants include at least one of: a participant transferred from an established communication session (e.g., a communication session of the communication platform **630**) into the conference; a participant that establishes a communication session (e.g., a communication session of the communication platform **630**) with an endpoint that is mapped to the conference (e.g., a conference of the conference system **600**), and a participant specified by an API request received by the application programming interface (e.g., **653**) of the conferencing system **600**.

In some implementations, determining participants of the conference includes determining participant regions, as described above for S**110** of FIG. **1**. In some implementations, the conference orchestration service **611** determines the participant regions of each participant. In some implementations, the conference state manager **612** determines the participant regions of each participant. In some implementations, participant regions are specified by an API call received by the system **600**. In some implementations, participant regions are specified by an API call received by the application layer interface **653** of the conference state manager **612**. In some implementations, the participant regions of the conference are specified by at least one conference request (e.g., a SIP request) received by the conference orchestration service **611** via the communication protocol interface **651**. In some implementations, participant regions of each participant of the conference are identified by respective endpoint identifiers (e.g., a telephone number) of the corresponding participant. In some implementations, participant regions of each participant are determined based on at least one of an area code and a country code of an endpoint (e.g., a telephone number) of the participant. For example, as shown in FIG. **7**, participant regions for each of the participants P**8**, P**9** and P**11** of the conference **2** (represented by the conference **2** state **712**) are determined to be "California, USA" based on the area code ("415") of the corresponding telephone numbers. Similarly, as shown in FIG. **7**, participant regions for each of the participants P**7** and P**10** of the conference **2** (represented by the conference **2** state **712**) are determined to be "London, England" based on the country code for England ("44") an the area code for London ("020") of the corresponding telephone numbers.

4.1.1 Application Layer Requests

In some implementations, responsive to the request for the new conference, the conference orchestration service **611** provides an application layer request (e.g., an HTTP request) to the conference state manager **612** (process S**1011** of FIG. **10**). In some implementations, responsive to the request for the new conference, the application layer interface **652** of the conference orchestration service **611** provides the application layer request to the application layer interface **654** of the conference state manager. In some implementations, the application layer request of the process S**1011** specifies participants of the conference. In some implementations, the application layer request of the process S**1011** specifies participant regions of the participants of the conference.

In some implementations, responsive to the application layer request of the process S**1011**, the conference state manager **612** determines participants of the conference, as described above. In some implementations, responsive to the application layer request of the process S**1011**, the conference state manager **612** determines participant regions of the participants of the conference, as described above.

In some implementations, responsive to the application layer request of the process S**1011**, the conference state manager **612** generates conference state for the conference (e.g., the conference state of FIG. **7**). In some implementations, responsive to the application layer request of the process S**1011**, the conference state manager **612** generates conference state for the conference (e.g., the conference state of FIG. **7**) and stores the generated conference state (e.g., as the conference state **661** of the conference database **614**).

In some implementations, the conference state includes the determined participants and the determined participant regions of the participants for the conference.

In some implementations, responsive to the application layer request of the process S**1011**, the conference state manager **612** provides an application layer request (e.g., an HTTP request) to the mixer state manager (process S**1012** of FIG. **10**). In some implementations, responsive to the application layer request of the process S**1011**, the application layer interface **655** of the conference state manger **612** provides the application layer request to the application layer interface **656** of the mixer state manager **613**. In some implementations, the application layer request of the process S**1012** specifies participants of the conference. In some implementations, the application layer request of the process S**1012** specifies participant regions of the participants of the conference.

In some implementations, responsive to the application layer request of the process S**1012**, the mixer state manager **613** allocates the mixers of the conference (process S**1020**).

4.2 Allocating Mixers

In some implementations, the process S**1020** functions to control the system **600** to allocate mixers (e.g., the mixers **621***a-d*, **622***a-d*, and **623***a-d*) of the conference (e.g., a conference of the conference states **711**, **712** and **713**), the mixers being mixers of the set of distributed mixers (e.g., **620** of FIG. **6**). Allocating mixers includes generating a mixer topology (e.g., a mixer topology of FIGS. **9**A-D) that specifies an assignment of each determined participant (e.g., participants P**1**-P**17** of FIGS. **7** and **9**A-B) to at least one input channel (e.g., channels **1**-**6** of FIGS. **8** and **9**A-D) of at least one mixer (e.g., the mixers **621***a-d*, **622***a-d*, and **623***a-d*) of the set of distributed mixers (e.g., **620**). In some implementations, the mixer state manager **613** generates the mixer topology (e.g., one of the mixer topologies of FIGS. **9**A-D). In some implementations, the mixer state manager **613** stores the mixer topology.

In some implementations the mixer state manager **613** allocates each determined participant to a single mixer. In some implementations, the mixer state manager **613** allocates the determined participants to multiple mixers to provide increased participant capacity for a conference (e.g., as shown in the mixer topology of FIG. **9**B). In some implementations, the mixer state manager **613** allocates the determined participants to multiple mixers to provide a subset of the participants with regional mixing within the conference (e.g., as shown in the mixer topology of FIG. **9**C). In some implementations, the mixer state manager **613** allocates mixers of the conference by bridging media of the conference between mixers of the set of distributed mixers. In some implementations, the mixer state manager **613** allocates mixers of the conference by bridging media such that a mixer output channel is mixed as an input to a different mixer. In some implementations, the mixer state manager **613** allocates mixers of the conference by allocating mixer output channels of at least two mixers to respective input channels of at least one mixer (e.g., as shown in the mixer topology of FIG. **9**D).

In some implementations, responsive to the application layer request of the process S**1012**, the mixer state manager **613** allocates the mixers of the conference (process S**1020**).

In some implementations, the mixer state manager **613** assigns each determined participant to at least one input channel based on a participant region determined for the participant.

In some implementations, the application layer request of the process S**1012** specifies the determined participants. In some implementations, the application layer request of the process S**1012** specifies participant regions of the determined participants. In some implementations, the mixer state manager **613** determines participant regions of the determined participants, as described above.

In some implementations, the mixer state manager **613** assigns each determined participant to at least one input channel of at least one mixer system based on the mixer state **662**. FIG. **8** depicts exemplary mixer state **662**.

In some implementations, the mixer state manager **613** assigns each determined participant to at least one free input channel of at least one mixer system, and the mixer state manager **613** determines whether a mixer input channels is free based on the mixer state **662**. In some implementations, the mixer state manager **613** updates the mixer state **662** after assignment of participants to input channels, to indicated that assigned channels are in use.

As an example, responsive to an application layer request provided by the conference state manager **612** for the conference corresponding to the conference state **711** (of FIG. **7**), the mixer state manager **613** assigns participants P**1**-P**6** to previously free channels of mixers **621***a*, **621***b* and **621***c*, and generates the mixer topology **910** of FIGS. **9**A and **9**B. As shown in FIGS. **9**A and **9**B, for the conference state **711**, the mixer state manager **613** assigns the participants to channels **2** and **3** of mixer **621***a*, channels **2** and **3** of mixer **621***b*, and channels **3** and **4** of mixer **621***c*. The mixer state manager **613** assigns the output of the mixer **621***a* to channel **1** of mixer **621***b*, and assigns the output of the mixer **621***b* to channel **2** of mixer **621***c*. After assignment of the participants P**1**-P**6** to the respective mixer channels, the mixer state **662** indicates the assigned channels as being used, as shown in FIG. **8**. More specifically, mixer state **662** indicates channels **2** and **3** of mixer **621***a*, channels **1**, **2** and **3** of mixer **621***b*, channels **2**, **3** and **4** of mixer **621***c* as being in use.

In some implementations, the mixer state **662** indicates regions of each mixer (e.g., as shown in FIG. **8**).

As an example, responsive to an application layer request provided by the conference state manager **612** for the conference corresponding to the conference state **712** (of FIG. **7**), the mixer state manager **613** assigns participants P**7**-P**11** to previously free channels of mixers **621***d* and **623***a*, and generates the mixer topology **920** of FIGS. **9**A and **9**C. As shown in FIGS. **9**A and **9**C, for the conference state **712**, the mixer state manager **613** assigns the participants to channels **2**, **3** and **4** of mixer **621***d*, and channels **3** and **4** of mixer **623***a*. The mixer state manager **613** assigns the output of the mixer **621***d* to channel **2** of mixer **623***a*. After assignment of the participants P**7**-P**11** to the respective mixer channels, the mixer state **662** indicates the assigned channels as being used, as shown in FIG. **8**. More specifically, mixer state **662** indicates channels **2**, **3** and **4** of mixer **621***d*, and channels **2**, **3** and **4** of mixer **623***a* as being in use. For the for the conference state **712**, the mixer state manager **613** assigns the participants P**8**, P**9** and P**11** (which have "California, USA" as a participant region, e.g., as indicated by the "415" telephone number area code) to the mixer **621***d*, which is a mixer of region "California, USA" (as indicated by the mixer state **662**), and the mixer state manager **613** assigns the participants P**7** and P**10** (which have "London, England" as a participant region, e.g., as indicated by the "44" country code and "020" telephone number area code) to the mixer **623***a*, which is a mixer of region "London, England" (as indicated by the mixer state **662**).

As an example, responsive to an application layer request provided by the conference state manager **612** for the conference corresponding to the conference state **713** (of FIG. **7**), the mixer state manager **613** assigns participants P**12**-P**17** to previously free channels of mixers **621***a*, **621***b* and **622***d*, and generates the mixer topology **930** of FIGS. **9**A and **9**D. As shown in FIGS. **9**A and **9**D, for the conference state **713**, the mixer state manager **613** assigns the participants to channels **5** and **6** of mixer **621***a*, channels **5** and **6** of mixer **621***b*, and channels **3** and **4** of mixer **622***d*. The mixer state manager **613** assigns the output of the mixer **621***a* to channel **1** of mixer **622***d*, and assigns the output of the mixer **621***b* to channel **2** of mixer **622***d*. After assignment of the participants P**12**-P**17** to the respective mixer channels, the mixer state **662** indicates the assigned channels as being used, as shown in FIG. **8**.

In some implementations, the mixer state manager **613** allocates mixers as described above for S**120** of FIG. **2**. In some implementations, the mixer state manager **613** allocates mixers based on at least one of communication quality, packet loss, latency, packet dial delay (PDD), monetary cost to the platform provider, monetary price charged to account holder, media quality, mixer capacity, regional associations of participants and mixers, participant priority, and the like.

In some implementations, the mixer state manager **613** stores the generated mixer topology.

In some implementations, the mixer state manager **613** provides the generated mixer topology (e.g., one of the topologies **910**, **920**, and **930** of FIG. **9**A) to the conference state manager **612** (process S**1021**). In some implementations, the mixer state manager **613** provides the generated mixer topology to the conference state manager **612** via at least one of an application layer response and an application layer request. In some implementations, mixer state manager **613** uses the application layer interface **656** to provide the generated mixer topology to the application layer interface **655** of the conference state manager **612**.

In some implementations, responsive to the mixer topology provided by the mixer state manager **613**, the conference state manager **612** provides the mixer topology to the conference orchestration service manager **611** (process S**1022**). In some implementations, the conference state manager **612** provides the mixer topology to the conference orchestration service manager **611** via at least one of an application layer response and an application layer request. In some implementations, the conference state manager **612** provides the mixer topology to the conference orchestration service manager **611** uses the application layer interface **654** to provide the mixer topology to the application layer interface **652** of the conference orchestration service **611**. In some implementations, the conference orchestration service **611** stores the topology (e.g., as one of the mixer topologies **663**).

In some implementations, responsive to the mixer topology (e.g., received provided at the process S**1022**), the conference orchestration service **611** negotiates media across the allocated mixers (process S**1030**).

4.2.1 Bridging Mixers

In some implementations, the mixer bridging of two mixers is performed by the mixer state manager **613**. In some implementations, the bridging of two mixers is performed by the mixer state manager **613** during generation of the mixer topology (e.g., **910**, **920**, **930**), and the mixer state manager **613** bridges two mixers by instructing a main mixer (e.g., a mixer whose output is provided to an input of a child mixer) to dial in to a child mixer.

In some implementations, the mixer state manager **613** instructs the main mixer to dial in to the child mixer by providing an application layer request (e.g., an HTTP REST call) to the main mixer, the application layer request specifying the mixer identifier of the child mixer and the channel identifier of the channel to receive the output of the main mixer. In some implementations, responsive to the application layer request received by the main mixer, the main mixer dials into the child mixer and bridges the output of the main mixer to the input channel identified by the channel identifier by: providing the child mixer with a SIP INVITE message that specifies the main mixer in a SIP "From" header, specifies a mixer identifier of the child mixer as a parameter to the SIP INVITE message, and specifies the channel identifier of the channel in a custom SIP header (e.g., a SIP X-Header).

In some implementations, the mixer state manager **613** instructs the main mixer to dial in to the child mixer by providing an communication protocol interface request (e.g., a request provided by the communication protocol interface **657**) (e.g., a SIP message) to the main mixer, the communication protocol interface request (e.g., SIP message) specifying the mixer identifier of the child mixer and the channel identifier of the channel to receive the output of the main mixer. In some implementations, responsive to the communication protocol interface request (e.g., SIP message) received by the main mixer, the main mixer dials into the child mixer and bridges the output of the main mixer to the input channel identified by the channel identifier by: providing the child mixer with a SIP INVITE message that specifies the main mixer in a SIP "From" header, specifies a mixer identifier of the child mixer as a parameter to the SIP INVITE message, and specifies the channel identifier of the channel in a custom SIP header (e.g., a SIP X-Header).

In some implementations, the bridging of two mixers, as described above, is performed by the conference orchestration service **611**.

4.3 Negotiating Media

In some implementations, the process S**1030** functions to control the system **600** to negotiate media across the allocated mixers (e.g., the mixer systems allocated at the process S**1020**). In some implementations, negotiating media across the allocated mixers includes routing media of each determined participant to the respective assigned mixer input channel. In some implementations, negotiating media across the allocated mixers includes starting the conference. In some implementations, the routing is performed by the conference orchestration service **611** in accordance with a signaling protocol.

In some implementations, the conference orchestration service **611** negotiates the media across the allocated mixers by routing media of each conference participant (e.g., participant media received from the call router **631** via the communication protocol interface **651**) to a respective mixer input channel. In some implementations, the conference orchestration service **611** determines a mixer input channel for a conference participant based on the mixer topology generated by the mixer state manager **613** for the conference (e.g., a mixer topology of the topologies **663**). In some implementations, the conference orchestration service **611** uses the communication protocol interface **651** to receive participant media from the communication platform **630** (e.g., from the call router **631**). In some implementations, participant media is media of a communication session of the communication platform **630**. In some implementations, the conference orchestration service **611** uses the communication protocol interface **651** to provide media of each participant of the conference to a respective mixer channel. In some implementations, the communication protocol interface **651** is a SIP interface, the conference orchestration service **611** uses the communication protocol interface **651** to receive participant media, and the conference orchestration service **611** uses the communication protocol interface **651** to provide media of each participant of the conference to a respective mixer channel.

In some implementations, negotiating the media across the allocated mixers includes the conference orchestration service **611** using the communication protocol interface **651** to perform signaling handshaking between media resources of the conference (e.g., participant media resources of the conference) and mixers allocated to the conference (as indicated by the mixer topology of the conference). In some implementations, the signaling handshaking is performed in accordance with SIP. In some implementations, the conference orchestration service **611** establishes the mixer topology by sending each mixer of the topology a SIP INVITE message that specifies at least a corresponding mixer identifier and a channel identifier assigned to the corresponding participant as indicated by the mixer topology (e.g., a topology of the mixer topologies **663**). In some implementations, the conference orchestration service **611** establishes the mixer topology by sending each mixer of the topology a SIP INVITE message that specifies at least a corresponding conference participant, mixer identifier and a channel identifier assigned to the corresponding participant as indicated by the mixer topology (e.g., a topology of the mixer topologies **663**).

In some implementations, the conference orchestration service **611** establishes the mixer topology by: determining conference participants (as described above); for each participant, determining the assigned mixer and channel as indicated by the mixer topology (e.g., one of the topologies **663**) for the conference; for each participant, providing a SIP INVITE message to the assigned mixer. In some implementations, the SIP INVITE message specifies the conference participant in a SIP "From" header, specifies a mixer identifier of the mixer (as identified by the mixer topology) as a parameter to the SIP INVITE request, and specifies a channel identifier of the channel (as identified by the mixer topology) in a custom SIP header (e.g., a SIP X-Header).

As an example, for the conference **1** of the mixer topology **910** of FIGS. **9**A and **9**B, the conference orchestration service **611** routes media of participant P**1** (received at interface **651**, e.g., a SIP interface) to the channel **2** of the mixer **621***a* (e.g., by using SIP), routes media of participant P**2** (received at interface **651**) to the channel **3** of the mixer **621***a* (e.g., by using SIP), routes media of participant P**3** (received at interface **651**) to the channel **2** of the mixer **621***b* (e.g., by using SIP), routes media of participant P**4** (received at interface **651**) to the channel **3** of the mixer **621***b* (e.g., by using SIP), routes media of participant P**5** (received at interface **651**) to the channel **3** of the mixer **621***c* (e.g., by using SIP), and routes media of participant P**6** (received at interface **651**) to the channel **4** of the mixer **621***c* (e.g., by using SIP). The output of the mixer **621***a* is bridged to the channel **1** of the mixer **621***b*, the output of the mixer **621***b* is bridged to the channel **2** of the mixer **621***c*, and the bridging of the mixer outputs is performed as described above. The output of the mixer **621***c* is the output of the mixer topology **910**, and therefore the output of the mixer **621***c* is provided by the mixer **621***c* to the conference orchestration service **611** (e.g., via SIP), and the conference orchestration service **611** provides the output of the mixer **621***c* to each conference participant via respective communication sessions (e.g., SIP communication sessions) (e.g., communication sessions of the call router **631**).

5. METHOD OF FIG. 11

The method **1100** of FIG. **11** is performed at a conferencing system (e.g., **600** of FIG. **6**) constructed to operate scalable conferencing services, the conferencing system including a conference orchestration service (e.g., **611**), a conference state manager (e.g., **612**), a mixer state manager (e.g., **613**), and a set of distributed mixers (e.g., **620**), and the method is performed responsive to a request for a new conference that is received via at least one of an application layer interface (e.g., **653**) of the conferencing system and a signaling protocol communication interface (e.g., **651**) of the conference orchestration service (e.g., **611**). The method **1100** includes: determining participants of the conference and participant regions for each determined participant (process S**1100**), generating a mixer topology (e.g., a mixer topology of FIGS. **9**A-D) by using the mixer state manager (e.g., **613**), the mixer topology specifying an assignment of each determined participant to at least one input channel of a plurality of mixers of the set of distributed mixers (e.g., **620**), the mixer state manager generating the mixer topology based on the determined participant regions and at least one regional association of a mixer of the set of distributed mixers (process S**1120**), and routing media of each determined participant to the assigned at least one input channel according to the generated mixer topology by using the conference orchestration service (e.g., **611**) (process S**1130**). The mixer state manager (e.g., **613**) generates the topology responsive to an application layer request provided by the conference state manager (e.g., **612**), the conference state manager provides the application layer request responsive to an application layer request provided by the conference orchestration service (e.g., **611**), the routing is performed by the conference orchestration service in accordance with a signaling protocol, and the conference orchestration service receives the generated mixer topology from the mixer state manager via the conference state manager.

In some implementations, the generated mixer topology is stored by the mixer state manager. In some implementations, the generated mixer topology is stored at the mixer state manager. In some implementations, the generated mixer topology is stored at a storage medium (e.g., **1205** of FIG. **12**) of the system **600**.

In some implementations, the system **600** performs the processes S**1110**-S**1130**. In some implementations, the conference orchestration service **611** (of FIG. **6**) performs the process S**1110**. In some implementations, the mixer state manager **613** (of FIG. **6**) performs the process S**1120**. In some implementations, the conference orchestration service **611** (of FIG. **6**) performs the process S**1130**.

In some implementations, the process S**1110** is similar to the process S**1010** of FIG. **10**. In some implementations, the process S**1120** is similar to the process S**1020** of FIG. **10**. In some implementations, the process S**1130** is similar to the process S**1030** of FIG. **10**.

In some implementations, the mixer state manager manages mixer state information for each mixer of the set of distributed mixers, and the mixer state information specifies a regional association of at least one mixer of the set of distributed mixers.

In some implementations, for each mixer managed by the mixer state manager, the mixer state information indicates a state for each input channel of the mixer. The mixer state manager assigns each determined participant to at least one free input channel of a plurality of mixers of the set of distributed mixers, and each free input channel is identified by the mixer state information.

In some implementations, the conference state is managed by the conference state manager, the conference state manger provides the conference state to the mixer state manager via the application layer request provided by the conference state manager, and the mixer state manager generates the mixer topology by using the conference state.

In some implementations, the mixer state manager determines the participant regions for each determined participant by using the conference state provided by the conference state manager. The mixer state manager determines regions for each mixer by using the mixer state managed by the mixer state manager. For at least one determined participant, the mixer state manager determines a mixer located in a region that matches the participant region of the determined participant, and the mixer state manager assigns the determined participant to an input channel of the mixer located in the matching region.

In some implementations, the mixer state manager assigns each determined participant to at least one input channel based on respective participant priority values.

6. SYSTEM ARCHITECTURE

Conference System

FIG. **12** is an architecture diagram of a system (e.g., the conference system **600** of FIG. **6**) according to an implementation in which the system is implemented by a server device. In some implementations, the system is implemented by a plurality of devices. In some implementations, the system **600** is similar to the system **100** of FIG. **1**.

The bus **1201** interfaces with the processors **1201**A-**1201**N, the main memory (e.g., a random access memory (RAM)) **1222**, a read only memory (ROM) **1204**, a processor-readable storage medium **1205**, a display device **1207**, a user input device **1208**, and a network device **1211**.

The processors **1201**A-**1201**N may take many forms, such as ARM processors, X86 processors, and the like.

In some implementations, the system (e.g., **600**) includes at least one of a central processing unit (processor) and a multi-processor unit (MPU).

The processors **1201**A-**1201**N and the main memory **1222** form a processing unit **1299**. In some embodiments, the processing unit includes one or more processors communicatively coupled to one or more of a RAM, ROM, and machine-readable storage medium; the one or more processors of the processing unit receive instructions stored by the one or more of a RAM, ROM, and machine-readable storage medium via a bus; and the one or more processors execute the received instructions. In some embodiments, the processing unit is an ASIC (Application-Specific Integrated Circuit). In some embodiments, the processing unit is a SoC (System-on-Chip). In some embodiments, the processing unit includes one or more of a conference management system, a conference orchestration service, a conference state manager, a mixer state manager, and a conference database, and mixing resources.

The network adapter device **1211** provides one or more wired or wireless interfaces for exchanging data and commands between the system (e.g., **600**) and other devices, such as a mixer, and a communication platform (e.g., **630**). Such wired and wireless interfaces include, for example, a universal serial bus (USB) interface, Bluetooth interface, Wi-Fi interface, Ethernet interface, near field communication (NFC) interface, and the like.

Machine-executable instructions in software programs (such as an operating system, application programs, and device drivers) are loaded into the memory **1222** (of the processing unit **1299**) from the processor-readable storage medium **1205**, the ROM **1204** or any other storage location. During execution of these software programs, the respective machine-executable instructions are accessed by at least one of processors **1201**A-**1201**N (of the processing unit **1299**) via the bus **1201**, and then executed by at least one of processors **1201**A-**1201**N. Data used by the software programs are also stored in the memory **1222**, and such data is accessed by at least one of processors **1201**A-**1201**N during execution of the machine-executable instructions of the software programs. The processor-readable storage medium **1205** is one of (or a combination of two or more of) a hard drive, a flash drive, a DVD, a CD, an optical disk, a floppy disk, a flash storage, a solid state drive, a ROM, an EEPROM, an electronic circuit, a semiconductor memory device, and the like. The processor-readable storage medium **1205** includes machine-executable instructions (and related data) for an operating system **1212**, software programs **1213**, device drivers **1214**, mixing resources **1215**, and the conference management system **610**. The machine-executable instructions (and related data) for the mixing resources **1215** include machine-executable instructions (and related data) for one or more mixers (e.g., a mixer of the distributed mixing resources **620** of FIG. **6**). The machine-executable instructions (and related data) for the conference management system **610** include machine-executable instructions (and related data) for the conference orchestration service **611**, the conference state manager **612**, the mixer state manager **613**, and the conference database **614**.

In some implementations, the conference management system **610** is implemented as a server device that is separate from server devices of the mixing resources.

7. SYSTEM ARCHITECTURE

Mixer Device

FIG. **13** is an architecture diagram of a mixer region (e.g., the mixer region **621** of FIG. **6**) according to an implementation in which the mixer region is implemented by a server device. In some implementations, the mixer region is implemented by a plurality of devices. In some implementations, the mixer region is similar to the mixer regions of **120** of FIG. **1**.

The bus **1301** interfaces with the processors **1301**A-**1301**N, the main memory (e.g., a random access memory (RAM)) **1322**, a read only memory (ROM) **1304**, a processor-readable storage medium **1305**, a display device **1307**, a user input device **1308**, and a network device **1311**.

The processors **1301**A-**1301**N may take many forms, such as ARM processors, X86 processors, and the like.

In some implementations, the server device includes at least one of a central processing unit (processor) and a multi-processor unit (MPU).

The processors **1301**A-**1301**N and the main memory **1322** form a processing unit **1399**. In some embodiments, the processing unit includes one or more processors communicatively coupled to one or more of a RAM, ROM, and machine-readable storage medium; the one or more processors of the processing unit receive instructions stored by the one or more of a RAM, ROM, and machine-readable storage medium via a bus; and the one or more processors execute the received instructions. In some embodiments, the processing unit is an ASIC (Application-Specific Integrated Circuit). In some embodiments, the processing unit is a SoC (System-on-Chip). In some embodiments, the processing unit includes one or more mixers.

The network adapter device **1311** provides one or more wired or wireless interfaces for exchanging data and commands between the server device and other devices, such as a server device of a conference management system (e.g., **610**). Such wired and wireless interfaces include, for example, a universal serial bus (USB) interface, Bluetooth interface, Wi-Fi interface, Ethernet interface, near field communication (NFC) interface, and the like.

Machine-executable instructions in software programs (such as an operating system, application programs, and device drivers) are loaded into the memory **1322** (of the processing unit **1399**) from the processor-readable storage medium **1305**, the ROM **1304** or any other storage location. During execution of these software programs, the respective machine-executable instructions are accessed by at least one of processors **1301**A-**1301**N (of the processing unit **1399**) via the bus **1301**, and then executed by at least one of processors **1301**A-**1301**N. Data used by the software programs are also stored in the memory **1322**, and such data is accessed by at least one of processors **1301**A-**1301**N during execution of the machine-executable instructions of the software programs. The processor-readable storage medium **1305** is one of (or a combination of two or more of) a hard drive, a flash drive, a DVD, a CD, an optical disk, a floppy disk, a flash storage, a solid state drive, a ROM, an EEPROM, an electronic circuit, a semiconductor memory device, and the like. The processor-readable storage medium **1305** includes machine-executable instructions (and related data) for an operating system **1312**, software programs **1313**, device drivers **1314**, and the mixers **621***a-d*.

8. MACHINES

The system and methods of the preferred embodiments and variations thereof can be embodied and/or implemented at least in part as a machine configured to receive a computer-readable medium storing computer-readable instructions. The instructions are preferably executed by computer-executable components preferably integrated with the media and signaling components of a conferencing system. The computer-readable medium can be stored on any suitable computer-readable media such as RAMs, ROMs, flash memory, EEPROMs, optical devices (CD or DVD), hard drives, floppy drives, or any suitable device. The computer-executable component is preferably a general or application specific processor, but any suitable dedicated hardware or hardware/firmware combination device can alternatively or additionally execute the instructions.

9. CONCLUSION

As a person skilled in the art will recognize from the previous detailed description and from the figures and claims, modifications and changes can be made to the preferred embodiments of the invention without departing from the scope of this invention defined in the following claims.

What is claimed is:

1. A method, comprising: at a conferencing system constructed to operate scalable conferencing services, the conferencing system including a conference orchestration service, a conference state manager, a mixer state manager, and a set of distributed mixers:

receiving a request for a new conference via at least one of application layer interface of the conferencing system and a signaling protocol communication interface of the conference orchestration service;

allocating mixers of the conference, the mixers being mixers of the set of distributed mixers; and

negotiating media across the allocated mixers,

wherein receiving a request for a new conference comprises determining participants of the conference,

wherein allocating mixers of the conference comprises:

generating a mixer topology that specifies an assignment of each determined participant to at least one input channel of at least one mixer of the set of distributed mixers,

wherein negotiating media across the allocated mixers comprises routing media of each determined participant to the assigned at least one input channel, and starting the conference,

wherein the media is routed according to the generated mixer topology, and

wherein the mixer state manager generates the topology responsive to an application layer request provided by the conference state manager, the conference state manager provides the application layer request responsive to an application layer request provided by the conference orchestration service, the routing is performed by the conference orchestration service in accordance with a signaling protocol, and the conference orchestration service receives the generated mixer topology from the mixer state manager via the conference state manager.

2. The method of claim 1, wherein the signaling protocol communication interface is a Session Initiation Protocol (SIP) interface.

3. The method of claim 1, wherein the conferencing system is a conferencing system of a communication platform, and the conference orchestration service receives the request for the new conference from a call router of the communication platform via the signaling protocol communication interface.

4. The method of claim 1, wherein participants include at least one of:

a participant transferred from an established communication session into the conference;

a participant that establishes a communication session with an endpoint that is mapped to the conference; and

a participant specified by an API request received by the application layer interface of the conferencing system.

5. The method of claim 1, wherein allocating mixers of the conference comprises: bridging media of the conference between mixers of the set of distributed mixers.

6. The method of claim 1, wherein receiving a request for a new conference comprises determining participant regions of the determined participants.

7. The method of claim 6, wherein the conferencing system determines a participant region of a participant based on at least one of an area code and a country code of an endpoint of the participant.

8. The method of claim 7, wherein assigning each determined participant to at least one input channel of at least one mixer system of the set of distributed mixers comprises: assigning each determined participant to at least one input channel based on a participant region determined for the participant.

9. The method of claim 1, wherein the conference state manager is constructed to maintain conference state of the conference, and to notify the conference orchestration service of conference state changes via the application layer communication interface.

10. The method of claim 1, further comprising transitioning the mixer topology according to new conditions.

11. A method comprising: at a conferencing system constructed to operate scalable conferencing services, the conferencing system including a conference orchestration service, a conference state manager, a mixer state manager, and a set of distributed mixers:

responsive to a request for a new conference that is received via at least one of application layer interface of the conferencing system and a signaling protocol communication interface of the conference orchestration service:

determining participants of the conference and participant regions for each determined participant;

generating a mixer topology by using the mixer state manager, the mixer topology specifying an assignment of each determined participant to at least one input channel of a plurality of mixers of the set of distributed mixers, the mixer state manager generating the mixer topology based on the determined participant regions and at least one regional association of a mixer of the set of distributed mixers; and

routing media of each determined participant to the assigned at least one input channel according to the generated mixer topology by using the conference orchestration service;

wherein the mixer state manager generates the topology responsive to an application layer request provided by the conference state manager, the conference state manager provides the application layer request responsive to an application layer request provided by the conference orchestration service, the routing is performed by the conference orchestration service in accordance with a signaling protocol, and the conference orchestration service receives the generated mixer topology from the mixer state manager via the conference state manager.

12. The method of claim 11, wherein the mixer state manager manages mixer state information for each mixer of the set of distributed mixers, and wherein the mixer state information specifies a regional association of at least one mixer of the set of distributed mixers.

13. The method of claim 12, wherein for each mixer managed by the mixer state manager, the mixer state information indicates a state for each input channel of the mixer, and wherein the mixer state manager assigns each determined participant to at least one free input channel of a plurality of mixers of the set of distributed mixers, each free input channel being identified by the mixer state information.

14. The method of claim 11, wherein determining participants of the conference comprises: identifying participants specified in at least one of an application layer request and an application layer response received via the application layer interface.

15. The method of claim 11, wherein determining participants of the conference comprises: identifying participants specified in at least one conference request received via the signaling protocol communication interface of the conference orchestration service.

16. The method of claim 11, wherein the mixer state manager assigns each determined participant to at least one input channel based on respective participant priority values.

17. The method of claim 11, wherein responsive to an application layer request provided by the conference orchestration service, the conference state manger generates conference state of the conference based on information of the application layer request, and wherein the generated conference state includes the determined participants and the determined participant regions of the participants for the conference.

18. The method of claim 17, wherein the conference state is managed by the conference state manager, wherein the conference state manger provides the conference state to the mixer state manager via the application layer request provided by the conference state manager, and wherein the mixer state manager generates the mixer topology by using the conference state.

19. The method of claim 18,

wherein the mixer state manager determines the participant regions for each determined participant by using the conference state provided by the conference state manager,

wherein the mixer state manager determines regions for each mixer by using the mixer state managed by the mixer state manager, and

wherein, for at least one determined participant,

the mixer state manager determines a mixer located in a region that matches the participant region of the determined participant; and

assigns the determined participant to an input channel of the mixer located in the matching region.

20. A method comprising: at a conferencing system constructed to operate scalable conferencing services, the conferencing system including a conference orchestration service, a conference state manager, a mixer state manager, and a set of distributed mixers:

responsive to a request for a new conference that is received via at least one of application layer interface of the conferencing system and a signaling protocol communication interface of the conference orchestration service:

determining participants of the conference;

generating a mixer topology by using the mixer state manager, the mixer topology specifying an assignment of each determined participant to at least one input channel of a plurality of mixers of the set of distributed mixers; and

routing media of each determined participant to the assigned at least one input channel according to the generated mixer topology by using the conference orchestration service;

wherein the mixer state manager generates the topology responsive to an application layer request provided by the conference state manager, the conference state manager provides the application layer request responsive to an application layer request provided by the conference orchestration service, the routing is performed by the conference orchestration service in accordance with a signaling protocol, and the conference orchestration service receives the generated mixer topology from the mixer state manager via the conference state manager.

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